# KIITG

keep it in the ground. international stop uranium mining news letter. january 1983


## EXTRA: COMPLETE INDEX

wise

ATOMENERGIO? NE DANKON
ATOOM ENERGIE? NEE BEDANKT
ATOMKRAFT? NEIN DANKE

# KIITG 25

Greetings friends, and welcome to KIITG no. 25. And our best wishes to you for 1983. We hope that the new year brings with it peace, but also the energy we need to continue fighting for peace.

Here at the WISE office in Amsterdam some changes will be made. Our efforts to find funding have not been extraordinarily successful -- but we continue to grow in supporters who read our information. So what will happen is that WISE in Amsterdam will have no paid staff in 1983, and that we become a volunteer organisation. Which means that Lin, for example, will continue doing KIITG in her free time, but that she will have to look for another job.

WISE doesn't intend to let the economic crisis get it down. We don't even intend to do less than we have been able to do in the past.

Keep It In The Ground has not been regular in the past, and it probably will not become more regular. But we are people, not machines, we keep on telling ourselves. Subscribers will always get 10 issues, but not all of them in a year!

Uranium mining is being fought all over the world for a variety, no, multitude of reasons. These pages are full of very tangible reasons - it is unhealthy, it is dangerous. But it is also a threat to many peoples lives: a threat to the cultural existence of many native peoples, a threat to the hard fought independence of people in formerly colonised countries. Uranium mining also has consequences for the people in the "user" countries. Nuclear power centralises energy production, makes nuclear bombs a reality, and also makes sure that social power remains in the hands of a few. Women will remain oppressed so long as our society is organised into decision makers and those who are told what to do. The decision makers are people who elect themselves to do that work; a society which oppresses no-one is built by the people themselves. Stopping uranium mining of course will not immediately build a better world, but it will give us the power to go on building up a world friendly for people.

CONTENTS




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# ENRICHMENT

## Australia

WILL AUSTRALIA BECOME THE 4TH URENCO PARTNER?

On October 22 1982 the following letter was sent to the Dutch parliament by the Minister for Economic Affairs (Terlouw) and the Minister for Foreign Affairs (van Agt).

To the Chair of the Dutch Parliament
den Haag
22 October 1982

At different times over the past years you have been informed of contact between Urenco and the Uranium Enrichment Group of Australia (UEGA) on the possibility of cooperation in the eventual establishment of a uranium enrichment industry in Australia.

The governments of the three Urenco countries, the Netherlands, the United Kingdom, and the Federal Republic of Germany have consistently reacted positively to the concept of such cooperation. The Lower House has always been kept informed on this. Recently the UEGA completed its in-depth analysis of the possible enrichment technologies of the U.S.A., France, Urenco, and Japan, and chose the Urenco-Centec technology as the basis for further study into an enrichment industry in Australia.

The choice has been made according to economic, technical and commercial factors.

The Australian government has approved the report and informed the Dutch government of this. The accompanying press release was issued at the same time.

The above mentioned study will take place in two phases:

1. a joint marketting study, to be able to guage the survival chances of an enrichment plant in Australia
2. in the case that phase 1 has positive results, an in-depth technical and economic feasibility study on an enrichment facility for Australia.

If the study has positive results, there is a possibility of joint construction and exploitation of an uranium enrichment facility in Australia using Urenco-Centec technology in a form of cooperation which will later be defined.

On the grounds of the Australian declaration a start can already be made for preparations on the intergovernmental agreements. Attention will of course also be paid to political and non-proliferation aspects. During the second phase of the study agreements will have to protect classified information provided by Urenco.

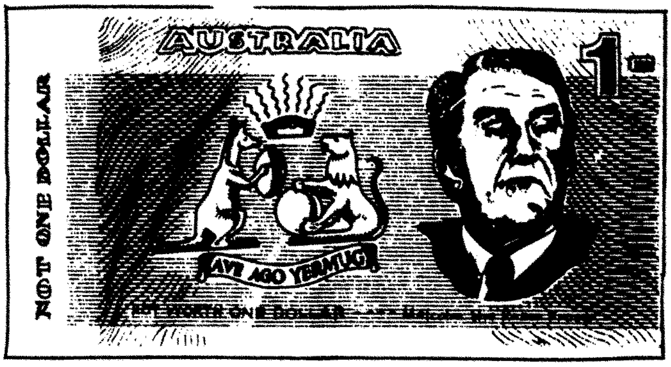
The government will keep the House informed of further developments.

UEGA PRESS RELEASE

It was announced today that the Uranium Enrichment Group of Australia (UEGA) has provided the Government with a further report on the Group's continuing study of the feasibility of establishing a uranium enrichment industry in Australia. UEGA last reported to the Government on April 30, 1981.

The report outlines UEGA's conclusions on choice of technology, site selection, market opportunities and the nature and timing of further work.

The Government has accepted UEGA's recommendation that the centrifuge technology offered by the European group Urenco-Centec (a consortium comprising the Federal Republic of Germany , Netherlands and United Kingdom interests) be the basis for further study by UEGA in relation to the possible establishment of




a uranium enrichment industry in Australia.

Factors identified by UEGA in support of its conclusion included economic superiority, proven technical and commercial capability, and flexibility for modular growth of Urenco-Centec technology.

The government has also accepted UEGA's recommendation that sites near Adelaide and Brisbane be further evaluated as UEGA advises they appear most likely to satisfy the requirements of a plant based on Urenco-Centec technology. In reaching this decision UEGA has also considered possible sites in Western Australia and the Northern Territory. Other State Governments chose not to participate. The Government notes that the selection of a final site will require the involvement of the chosen technology holder during the next phase of the study.

UEGA has advised the Government that the choice of Urenco Centec technology is subject to agreement of satisfactory terms and conditions with Urenco-Centec for the transfer of technology and to the satisfactory conclusion of all necessary inter-Governmental agreements.

UEGA also advised that a decision to proceed with a detailed engineering and feasibility study, expected to take at least two years, would depend on the outcome of a market survey to be undertaken with Urenco-Centec. This detailed survey of potential markets for enrichment is expected to take at least six months.

The Government has requested UEGA to report back to it on the outcome of the market survey and commercial arrangements proposed with Urenco-Centec before commencement of the study by the end of 1983.

The Government would like to express its appreciation of assistance given to Australia's enrichment studies by the six Governments of the four suppliers of enrichment technology under consideration by UEGA, namely the Federal Republic of Germany, the Netherlands, the United Kingdom, France, Japan and the United States.

Although Urenco-Centec enrichment technology will be the basis for further studies by UEGA on the feasibility of enrichment in Australia, this does not mean that Australia will cooperate only with the Urenco-Centec countries. UEGA has advised the government that there is a greater compatibility between Urenco-Centec and Japanese centrifuge technologies than between Japanese and other technologies and that the prospects for future technical and commercial cooperation with Japan apperared to be greater if Urenco-Centec technology were adopted.

Additionally the Government is committed to the concept of multinational participation in an enrichment plant in Australia should such an industry proceed. There may thus be opportunities for countries meeting the requirements of the Government's nuclear safeguards policy to take some equity in the enterprise.

The Government will continue to pay close attention to the nuclear non-proliferation and safeguards issues relating to uranium enrichment.

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KIITG comment next page ⟶

# kiitg comment

When this announcement was made in the Netherlands, a group of people immediately sought each other out to determine how the Dutch anti-nuclear movement can work against this development. First, we want to know how people in other countries of the Urenco Troika reacted to the news, and what plans they might have to oppose the establishment of a Urenco-Australia enrichment partnership.

Secondly we asked ourselves _why_ Urenco has interests in Australia. The enrichment market is not very stable at the present time. The enrichment plant proposed for Australia will probably have an annual capacity of 3000 tonnes swu (separative work units, the measure of enrichment capacity), or perhaps as much as 5000 tonnes swu, and its cost has been estimated at $1 billion, and $5 billion, in different news reports. However, the UEGA study said that it would be unlikely the market could cope with more than one enrichment plant and even then, it would be necessary to construct one that can operate at a very limited output, and expand when, and if, market demand increases. Even UEGA, with all its obvious optimism, concedes that this is not likely to occur before the early 1990's.

What should also be taken into account is that the FRG plans to build in Gronau. This plant has caused a controversy among Urenco partners, because the capacity of Gronau is far greater than the market can cope with.

On the speculative side, perhaps Urenco sees advantages in setting up an Australian factory to deal with, for example, Namibian uranium. There is a large anti-apartheids movement in the Netherlands putting strong pressure on the Dutch government not to enrich Namibian uranium. Australia, with its racist government which pays very little attention to voices of opposition, is a safe fall-back if Urenco can no longer enrich at Almelo.

The group in the Netherlands has a certain amount of contact already with several groups in Australia, opposing the Urenco partnership. (For that matter, opposing an enrichment industry in Australia). We have also heard that one group is writing an information pamphlet on enrichment. WISE is hoping to commission a study on enrichment and the world uranium market, with an emphasis on the present plan for Australia. All information people may have on this is very welcome. Further, the group hopes to keep public awareness in the Netherlands informed of all new developments, so that the plans do not disappear behind a curtain of secrecy.

Perhaps, if groups in the various Urenco countries feel the need, a meeting of representatives of the four countries could meet together in a year's time. We still have 2½ years before the plans are finalised for an enrichment facility in Australia.


contact:

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Vic Australia

## South Africa

### INSIDE VALINDABA: SOUTH AFRICAN ENRICHMENT PLANS STEADILY TAKING FORM

*Nucleonics Week, April 8*

Before the year is out, the first of the 50 or so modules providing the separative work units for the Uranium Enrichment Corp. of South Africa's semi-commercial plant will be floated on air cushions into a huge building on rolling farmland of Valindaba, 60 km north of Johannesburg, thus providing the first tangible evidence to outsiders that South Africa's enrichment programme is entering a new phase.

However, that phase - actual operation of Ucor's 300,000 swu plant - was dealt a blow in the government's new 1982-82 budget, which calls for a 15% inflation-adjusted reduction for Ucor funding, a figure which the government keeps secret. The funding cut will delay initial throughput of the plant from the late 1985/early 1986 schedule by at least one year, thus setting back South Africa's enrichment self-sufficiency by that much time.

Details of Ucor's programme were obtained by Nucleonics Week during a tour of the new plant -- the first time Ucor has permitted a representative of a news organisation inside the facility.

The plant is a mostly concrete building measuring 10 stories high and 170 m by 70 m. Adjacent to it are various support facilities, such as a compressor test building, a training centre, and a facility where separation elements - the heart of Ucor's technology - are being manufactured. The separation elements are the only parts being manufactured on site. NW was not allowed to view the the fabrication process or a completed element, nor was any information on the separation technology provided beyond what Ucor has already published. All other components are being manufactured in South Africa by domestic concerns or the South African subsidiaries of overseas firms. The semi-commercial plant is located about one-quarter mile up the road from Ucor's pilot plant, whose capacity is kept secret.

The pilot plant has proved Ucor's principles, and the semi-commercial plant will now prove the purportedly unique separation process on an industrial scale.

From a peak of 3,000 construction workers, the on-site labour force has dwindled considerably, with activities now directed to industrial fabrication. Security is described as extremely tight, not so much to prevent the leak of proprietary information, but to prevent sabotage, sources say.
The plant, built by South African contractors and sub-contractors which, like the component manufacturers, were awarded contracts on a competitive base, consists essentially of three floors. The top floor will house the process equipment and control room, the next floor below holds cabling, pipe connections and the ventilation system, all of which is in place, and the basement contains reservoirs and piping for lubricating oil and cooling water.
Ucor has a small UF6 plant in operation, and plans a significantly larger facility for operation in 1984-85. While that capacity is kept secret, Ucor said it will be enough to permit exports of UF6

## England

### CAPENHURST ENRICHMENT FOR MILITARY PURPOSES

UK: According to a news item in the Financial Times of June 30, it appears URENCO at Capenhurst will now be doing military enrichment.

This implies, then, that uranium contracted for by URENCO could well end up in Trident fuel assemblies.

"The Navy has given British Nuclear Fuels approval to start building a uranium enrichment plant at Capenhurst, Cheshire, to provide for Britain's nuclear submarine fleet.
"The project, expected to cost more than £100 million over the next four years, was frozen last year in Ministry of Defence economics on capital expenditure.
"The Navy has been fuelling its nuclear fleet with uranium enriched to high levels -- exceeding 90 per cent -- by the U.S. government, under a barter agreement involving the exchange of plutonium from the Ministry of Defence's reactor's such as Calder Hall and Chapelcross Under the terms of the new project BNFL will finance construction of an enrichment factory based on gas centrifuge technology".

The story continued that this plan was "more economic" and would save on redundancies the company has forecast at Capenhurst. It seems like an advertisement for the perfect company: we spend £100 million to save two jobs.

URENCO is a British-West German-Dutch consortium. Clearly this new, military, development affects the other countries in the consortium -- and all countries who trade with URENCO.

*Contact: Stop Urenco Campaign*
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*London WC1, UK*

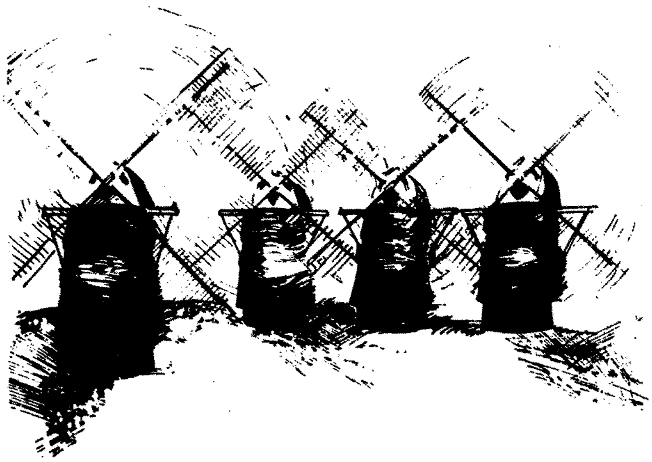
Source: Financial Times, June 30, Roger Moody

**Canada**

## AECB APPROVES ELDORADO NUCLEAR'S HEX EXPANSION AT PORT HOPE

The Atomic Energy Control Board has approved construction of Eldorado Nuclear's new uranium hexaflouride conversion plant in Port Hope, Ontario. The new plant will increase Eldorado's annual UF6 production to 14,500 tonnes U. (construction of this plant, together with that of the 18,000 tonnes U uranium trioxide refinery now being built in Blind River, Ontario, virtually guarantees that Eldorado will not build refining or conversion capacity in Saskatchewan this decade as the two plants could easily handle the maximum possible Canadian yellowcake production until 1990.)

Nuclear Free Press, Summer 1982



## KEEP IT IN THE GROUND SUPPORT PLAN

As a service to the movement, WISE's KIITG newsletter needs the support of the movement.

This means we need you to help us through another year.

YES, I like the KIITG project and want to help finance it.

- o I will send $5 monthly to the WISE post account, marked "For KIITG"
- o I enclose a yearly donation of $50
  $100

Wilt U automatisch overschrijven? Schrijft, of belt naar ons, en wij zullen dat dan regelen. Bedankt.

In some countries you can make use of an automatic depositing system. If that is true for your country, and if you have a relay in your country, then contact them to have automatic, monthly payments forwarded to the WISE Keep It In The Ground Project.

# MEETING

URANIUM IN SPAIN:
FIGHTING NUCLEAR MUST ALSO TAKE THE PROBLEM OF URANIUM INTO ACCOUNT

Over 50% of the Spanish countryside is affected by uranium mining exploration licenses. This divvying up of parcels of perfectly good farm land began in 1977, and has been going fast since then. Not without opposition.

From October 9-12 the Third Iberian Peninsula Conference against Uranium Mining took place. The previous conferences were held in Portugal and in Salamanca. This one was held near Vic, Catalonia, in the foothills of the Pyrannees, in a building which came into being in the 12th century.

Actual uranium mining is taking place on a small scale in Spain - some 115 tons per year are mined. These mines are in Extremadura. La Habla was opened in 1965, the first of the La Habla uranium mines is now deplete. The plans are to use the mine as a radioactive waste storage site. In 1976 a mill was built. At the beginning of 1980 journalists from El Ecologista visited La Habla. They found two things: one, the subject of uranium mining was taboe, and two, radiation sicknesses were common. The average lifespan of a mine worker there is 54; they begin employment at about 27 and work 22 years. If they started work at the age of 20, they would probably die at 42. Not one of the mine workers was on a pension for old age reasons - every single pension was given for illness reasons. 54% of the mineworkers suffer from chronic tiredness, and about the same number of people suffer from low blood pressure. 30% of the women in the area have had a miscarriage . 25% of the people have lung and bronchial diseases.

Madrid, however, wants energy self-sufficiency for Spain (which includes, according to Madrid, The Basque Country and Catalonia). Nuclear power was not an election issue, so it is difficult to say at this point in time whether the socialists will follow the previous government's uranium policies. One of the Socialist's first actions was to buy coal from South Africa - now the potential coal production is at a level which makes nuclear power redundant.

According to Mariá Millan and Jaume Morron, members of the Comité Anti Nucleare Catalonia (CANC), no research has been done at the government level into energy self-sufficiency through appropriate energy -- renewable energy sources.

Jaume and Mariá presented the Third Iberian Conference with research they have worked on for the past two years: a document in which you can see every town and village affected by the Catalonian leases. They found, by searching in the so-called "public information", that 570 municipalities in Catalonia are affected. Most fall in the regions of Vic and Girona. In their introduction, Jaume and Mariá write that their first priority in making the report was to "inform, to mobilise, and to organise all the people who had nothing to gain and a lot to lose from the nuclearisation of the country". The intention now is to distribute this document to all 570 local government councils, to have each council individually say NO to the exploration projects. As all decisions relating to exploration are made in Madrid, the resounding NO will not have a legal effect, but will certainly have a political effect.

Several other groups represented at the Conference are also compiling similar reports for their regions, although none have worked so efficiently as the Catalonia people.

While the previous two conferences

discussed Iberian Peninsula problems and strategy, this years organisers decided to bring a more international perspective into their planning. The evening programme was filled with videos from anti uranium mining movements from other countries, and WISE was invited to talk about the Keep It In The Ground network.

*contact: Comite anti uranium de Vic*
*Carrer de Sant Just,1,3r*
*Vic, Catalonia.*

*CANC*
*Bruc 26, 2on*
*Barcelona, 10, Catalonia*

# DUTCH U

PLANNING A NUCLEAR FUTURE

The Netherlands: There are 2 nuclear power plants in the Netherlands, one pilot plant of 50 Mw, and a commercial plant of 500 Mw. In 1974 the plan came into being of building yet three more plants, but these have been temporarily put aside. The government still holds its options open on these plans, and a decision will be made dependent on the outcome of the present Broad Social Discussion taking place in the country. In this Discussion, the question is whether the future will have coal or uranium as basis for electrical energy production. Even if uranium is the chosen fuel, it is not clear whether the three proposed plants will be built. Whatever the outcome, a decision in favour of uranium will be a socially unacceptable one, and politically difficult to uphold.

The SEP (Cooperative Electricity Producers) of the Netherlands are not daunted by the BMD. They have already bought the necessary uranium for a third nuclear power plant. In 1975 the SEP decided to import this uranium. Up until now 500 tons has been purchased. All this uranium comes originally from Niger. It will be hexed in England.

The SEP has also ensured enrichment of the uranium, in the U.S. Meanwhile Holland's own enrichment plant, owned by Urenco, is almost dying for lack of contracts. The SEP thought it would work out cheaper to enrich it in the U.S., which was true at the time. The uranium, however, will be enriched just before conversion to fuel rods and use in the plant, which may take some time. In the mean time SEP has to pay the price contracted with the U.S., ƒ10 million (4.5 million dollars), the price it was in 1981. The rest of the contract will cost ƒ6320 million plus an annual rent of ƒ12 million.

This "action" of the SEP means that the first load of fuel for a Boiling Water reactor of 650 Mw and the quantity necessary for a first reload is secured. A "planned" plant which does not even come under the Discussion or even within the year plan of the SEP (until 1987). If the third nuclear power plant does not come, the SEP plans to sell the uranium to another country.

*Source: Atoomalarm 4 (1982).*

# HAS URANIUM A FUTURE ?

US: THE END OF URANIUM AS WE KNOW IT?

While the nuclear madhats met in an air of wild optimism last week for the seventh Uranium Institute annual symposium, the German Company Nukem was revealing that the US uranium market had virtually collapsed.

At the Uranium Institute symposium in London, Thomas Stauffer of the Vienna Diplomatic Academy told his audience that the best aid major oil exporting countries could make to the third world was in small and medium sized reactors. Gunther Radthe, who works withb the Dresdner Bank, was predicting that nuclear power would take the biggest share of an estimated $10,000 billion world investment in energy by the year 2000.

And professore Chauncy Starr, vice chair of the Electric Power Research Institute of California, said the US would fall short by a quarter of the electrical capacity needed to meet "minimum social expectations" by the turn of the century-- because of the tardiness in building nuclear plants.

But whatever the scientists believe, the miners are responding to reality - and fast. According to the latest Nukem market Report (Nukem handles about a quarter of the west's sales of uranium and is generally regarded as the industry's barometer on uranium markets) some 60 uranium mines closed - or defered opening - last year.

A "reverse market" has now developed, says Nukem, with the sellers buying uranium and the buyers selling. In other words, the utilities which normally purchase the bulk of US civil uranium production have been selling off their stockpiles (60% of the sellers of uranium in the first seven months of 1982 have been US utilities) - while uranium producers have been buying to meet long term contracts. (70% of the uranium was purchased in this way).

As long-term contracts expire, and presumably future contracts get scarcer as the demand for nuclear power falls, the producers will tend topurchase on the spot market to meet their contracts, rather than go to the expense of producing their own yellowcake.

One of the major reasons for the recent plummet in uranium prices (from a high of $42-$43 in 1979 to a current low of around $20), was the fact that the utilities started selling off some of their stockpiles in 1980. That didn't result in an immediate drop in uranium production. However, as the process has advanced over the last two years, the effect has been cumulative. According to Nukem, this is the checklist of closures and reductions in output of American mines:

TEXAS

*Chevron's* Panna Maria mine is the only one now operating.

Closed operations include:

Conquista *(Conoco/Pioneer)* at Crownpoint.

Felder mine *(Exxon)*

Reduction in output from:

Trevino in-situ leaching mine *(Conoco)*

El Mesquite *(Mobil)*.

NB. In situ leaching projects at four other locations are still functioning as "normal".

However, Conoco recently announced that it was dropping all uranium projects while US Steel is trying to sell its Texas uranium interests at Burns and Clay West. And Wyoming Minerals (subsidiary of Westinghouse) is currently closing down its Lamp-reach property.

NEW MEXICO

The only current producers are *Homestake*, at Milan (running at about one third capacity)
at Grants section 23 (reduced output).
*Kerr McGee's* Ambrosia Lake mill - well below capacity.
ABOUT TO CLOSE: *Gulf Oil's* Mariano Lake mine (ore depletion).
ON STANDBY are still all Kerr McGee's four mines.
CLOSED are the mines owned by:

*Western Nuclear (Phelps Dodge)*
*United Nuclear Corporation*
*Anaconda (ARCO)*
*Ranchers*
*Sohio (B.P.) and Reserve*

WYOMING

Working at only half capacity are:
the Petrochemics mine *(Getty Oil)*
Lucky Mac *(Pathfinder Mines/G.E.)*
Sweetwater *(Union Oil)*
Gas Hills *(Union Carbide)*
Bear Creek *(Rocky Mountain Energy)*
Because of the technical problems the only in situ leaching operation in the state, Ogle Petroleum's Bison Basin property still hasn't reached design capacity.

UTAH

Operations have been suspended at Atlas Corp's Moab mine, while Rio Algom (RTZ) is running at about half its capacity.
*Pateau Resources* Shootering Canyon mine and Energy Fuel's White Mesa project have not as yet been affected.

ARIZONA

*Anamax's* copper uranium operations (jointly owned by Amax and Anaconda) have continued.

COLORADO

Cotter Corp's Canon City mine is operating at reduced scale, as is Dawn Mining's (Newmont) Midnite mine (due to litigation with the Spokane native Americans over royalties).
*Union Carbide's* Uravan mill closed for five months in April.

FLORIDA

*Gardiner Inc* has closed its phosphate/uranium operations - leaving only Freeport McMoRan and IMC in the business.

Is this, then, an end to uranium mining as we know it in the United States?

It is too soon to tell Uranium exploration expenditure continues to reach record levels, and of course the overseas operations of some of these companies (notably Getty Oil, BP, RTZ) have not diminished in the slightest. Note too that some of these mines are being placed "on hold", and could be re-opened later, just as some of these mines closed in the 60's only to re-open ten years later.

It is important to see the cutback in uranium production in the context of so-called "recession". Virtually all the uranium producers in the US have been worse affected by the drop in copper, and other base metal prices than they have been by the collapse of the uranium price.

What is perhaps most significant is that some of the Big Oil companies, who during the 1970's managed to get more than half of the US economically recoverable uranium reserves, are now pulling out of mining altogether.

In the past few months, according to the US Mine Development Monthly (July 1982) Phillips announced the closure of its minerals division, Conoco has decided to pull completely out of mining, and Occidental is trying to sell its mineral units. All three companies have important uranium interests.

Exxon and Western Nuclear (Phelps Dodge) are among the other energy corporations which waver on the home front - but they have important uranium investments overseas. (Note however that Exxon recently pulled out of Yeelirrie in Western Australia).

It is also important to remember that the US continues to run the world's biggest nuclear programme (not to mention nuclear weapons arsenals) and therefore to require about half the western world's uranium production, in one form or another. Under current US legislation - introduced after the discovery of the uranium cartel in the 1970's - domestic utilities can purchase foreign uranium up to 60% of their needs by the end of this year, while all restrictions on uranium imports are due to be removed in 1984.

Earlier this year the US Senate passed an amendment to the Nuclear Regulatory Commision authorisation bill. If it becomes law it will allow the US utilities to import no more than 20% of their uranium needs. The bill has already incited cries of 'protectionism' from Canada and Australia, and may indeed lead to a revival of the uranium cartel, which was partly introduced to overcome price controls brought about by original US import restrictions.

Optimistically, even if this Bill becomes law, it may not be in time to save a large number of US mines.

*Roger Moody*

*sources: Nukem Market Report (summarised in Mining Journal 3/9/82)*
*MJ 4/6; 23/7/1982*
*FT 3/9/82*
*and the Gulliver File*

**WE WON! LOMEX GIVES UP IN CALIFORNIA**

We won! The Lomex Corporation has given up its plans to drill and mine in San Luis Obispo County. What's more, Lomex president, Hiram Bingham, stated on the phone that they are "dropping everything," relinquishing all their uranium claims, and "We have no further plans for California at all." We've booted Lomex out of the whole state!

The Oak Tree Alliance offers its deep gratitude and hearty congratulations to every person, organisation and official throughout the Salinas River Vally for every calorie and penny spent toward our victory. The first reason Mr Bingham cited for their defeat was that "the environmental climate out there is not a positive one to work in; the environmental climate of San Luis Obispo County especially" citing all the frustration and fighting.

The coalition of farmers, ranchers, Native Americans, environmentalists, and civic organisations, and officials and representatives at the local, state and federal levels disagreed.

When information is in the hands of the people, there is power too. From 1971 to 1977, the U.S. Forest Service allowed Lomex to drill without any environmental protection. In doing so, the USFS decided that no public information or participation was needed. The people downstream were thus rendered powerless to protect their water and property from Lomex's activities. Red Wind, a communal settlement of Native Americans and others, has a parcel of land in the middle of the Los Padres National Forest. Residents depend on the water wells for drinking and irrigation. But the radioactivity level in the water wells is now so high that drinking water has to be trucked into the village.

But, ever since the public was first informed (through the county) about their plans, Lomex has been stopped. Their plan to mine was stopped in 1979. Their latest drilling plan just became their last, and was the subject of a full Environmental Impact Statement (EIS) as a direct result of public involvement.

As the first federal EIS ever required for uranium exploratory drilling, this national precedent will help farmers, Native Americans, environmentalists and local governments elsewhere fighting to protect their land and water from the uranium industry. Such an EIS provides for the application of laws and public comment at an earlier stage in the uranium fuel cycle than ever before possible.

We must now address the degradation Lomex left us where they drilled before and now are readings of groundwater radioactive containment levels many times in excess of federal safety standards. It is also time for us to protect our water and land from further threats of contamination by making the call for a ban on uranium mining and exploration in our area a reality.

Contact: David Broadwater
Coordinator of the Uranium task force,
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Atascadero, California,
USA.

URANIUM - IS THERE ANY PROFIT LEFT?

*Ake Sundstrom, October 1982, Sweden*

Most people opposed to uranium mining emphasize the environmental issues, their doubts about nuclear reactor reliability or their fears about plutonium.

Now, another reason is becoming more and more apparent: nuclear power is not even profitable. This is the ultimate irony: the enormous risks are not compensated by any economic gain. On the contrary, the nuclear companies are suffering from staggering losses.

We know about the painful retreat of the reactor industry. All major companies are swimming in red ink. AEG in West Germany is on the brink of bankruptcy, to a high degree due to its nuclear adventure. Utilities with heavy nuclear committments are in deep trouble everywhere, with the plight in the state of Washington as a prime example.

In Sweden, the two last reactors (number 11 and 12) will, according to my estimates, produce unbelievable losses: about 5 billion US dollars. Even the bankers are warning against nuclear power. The whole industry is slowly collapsing. That is surely bad news for uranium mining companies.

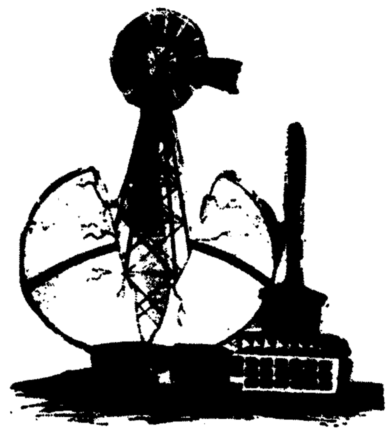
To me it is surprising that the economic issue has not been raised much earlier by the anti-nuclear movement. After all, it is easy to see that nuclear power has never been a viable proposition. It was introduced in the US with government subsidies for the initial research effort. Even so, nuclear plants could not possibly pay their way before 1973, because of low oil and coal prices. They were built only at big losses to the reactor companies, which tended to regard these initial deficits as a reasonable price for access to what everybody thought was a gold mine of the future.

With oil prices exploding in 1974 that golden age seemed to arrive.

Order books were filled and prospects looked bright indeed. New uranium mines were opened, prices surged to very high levels.

That glorious spell proved to be very short. When utilities rushed to sign new contracts they were short-sighted or even incompetent. They did not see the change in market conditions. With rising energy prices, consumers started to save and conserve. Previous demand forecasts became wildly unrealistic. They were revised - and then revised again. They are still far too high. The saving potential and the general flexability in the market economies continue to be underestimated.

The result is that very little new capacity is needed. On the contrary, most industrial countries have too much capacity. This is going to be the major problem for the rest of the decade.



The reactor industry is dying due to lack of new orders. It is caught in a vicious circle: to be cost-competitive it needs high electricity prices, but with high prices demand will disappear. Furthermore: government regulations are becoming stiffer, which tends to increase building costs. The out look is gloomy indeed - and the consequences are clear: more financial defaults will follow the AEG and Washington disaster.

Lower demand for electricity spells trouble for the uranium industry, which has expanded fast to meet that bright future foreseen a few years ago. Today, the capacity is roughly twice as high as current demand and stocks have risen to extreme levels. The price (in real terms) has been cut about 50% since 1979. Marginal mines are closing down at an increasing speed. New projects are abandoned. Only very rich ore bodies in very favourable locations are now being considered. Sweden is only one of many examples of uranium dreams going bust.

Even the nuclear people are now reluctantly admitting that problems do exist. But many believe them temporary, and look for a recovery in the 1990's. In my judgement, they will be wrong - again. The period of overcapacity and slow growth will be so long and the financial difficulties so profound, that precious little will remain of the reactor industry in ten years time.

Of course one should never say never. What can not be fully foreseeen is the impact of new technology. Better reactor designs may appear, cutting costs and improving safety. But this will take time - and time is fast running out.

In Sweden, the struggling reactor company ASEA Atom is trying to survive by developing heat reactors, to produce hot water for district heating systems. Similar plans exist in France and the USSR.

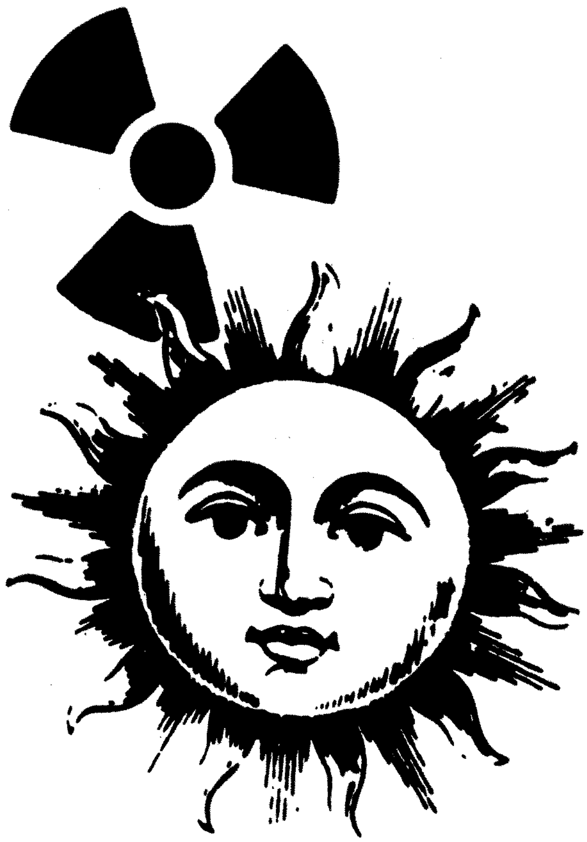
We don't know very much about these reactors, but my hunch is that they will be a new dead-end - for reasons similar to those we have seen in the power field. They are unlikely to be able to compete with "traditional" fuels and energy systems, and even more unlikely to match returns on investments in conservation and new energy efficient technology. One important factor is that oil and coal prices are going to rise much slower than is usually assumed (again due to reduced demand). One may also confidently predict, that safety problems are not going to be quite so easy to solve as the manufacturers are claiming.

The nuclear advocates are still basing their optimistic views on hopelessly outdated theories about energy demand and the role of energy as an 'engine' for industrial progress and economic welfare. Old ideas die slowly, but die they will. The rush into nuclear energy will soon be recognised as a mistake of gigantic dimensions, overshadowing other white elephants like the Concorde.

Persuing new technology for its own sake is a folly. The disease is particularly virulent among government agencies with a plentiful supply of tax-payers money. The private industry would never have risked that much, but they were foolish enough to follow the lead.

However the blame is to be distributed by future historians, quite a few enterprises have badly burned their fingers by believing in fairy tales. Some may be able to cover their losses from other activities. Others, like many uranium miners with no other source of income, are worse off.

It is increasingly clear that uranium should best be kept in the ground - also for economic reasons.



# RESOURCES

LAND GRAB: THE CORPORATE THEFT OF WISCONSIN'S MINERAL RESOURCES
A booklet by Al Gedicks , Jane Clokey, Robert Kennedy and Michael Soref.

In the past ten years multinational mining corporations have quietly leased over 900,000 acres of valuable farmland, forest and recreational land in the Lake Superior region of Northern Minnesota and the upper peninsula of Michigan. In addition to identified reserves of copper, nickel, zinc and vanadium, potentially rich deposits of radioactive uranium and thorium are believed to exist in the southernmost extension of the Canadian Shield geological formation in northern Wisconsin.

This enormous storehouse of untapped mineral wealth has attracted over 40 multinational mining and energy corporations to the region. Land Grab: The Corporate Theft of Wisconsin's Mineral Resources documents the how, why and where of mineral leasing in eight northern Wisconsin counties where mineral exploration is most intense: Forest, Florence, Marinette, Langlage, Oneida, Sawyer, Price and Rusk. Detailed maps are presented showing the location of mineral leasing in these eight counties. Accompanying tables show which corporations are most active in each county. Corporate profiles are presented for three of the largest corporations: Exxon, Inco and Phelps DOdge. Data is presented on the mechanisms for unified action among the mining companies based on an analysis of director and non-director links among the companies.

As of June 1981, over 400,000 acres of public and private lands in northern Wisconsin have passed into the hands of corporations like Exxon, Kerr-McGee, Universal Oil Products, Western Nuclear, Kennecott, Inco (Canadian), Minatome (French) and Urangesellschaft (West German). The data on corporate mineral leases reveals a pattern of extreme concentration of land holdings among a few powerful corporations. The fact that many of these companies are oil companies that have only recently aquired mining subsidiaries (Exxon, Universal Oil Products, Sohio, Getty etc) raises serious questions about the ability of these corporations to bring a successful and environmentally responsible mine into production. The corporate profile of Exxon examines Exxon's Highland uranium mine in Wyoming and shows numerous violations of Wyoming environmental regualtions.

The study raises serious questions about whether the large scale corporate mining operations can coexist with northern Wisconsin's most important rural industries: dairying, agriculture, forestry, tourism and recreation. The study argues that the long range planning of these global corporations envisions the Lake Superior region as a new resource colony that will provide cheap raw materials for corporate growth and diversification and a dumping ground for the toxic and radioactive wastes left behind after the mining process.

A major conclusion of the study is that multinational mining corporations are strategically vulnerable at the earliest stage of the mining and development process: mineral leasing. It is not too late to reverse the momentum of resource colonisation by the mining corporations. If Indian tribes and rural communites can avoid entering into unfavourable and inequitable lease agreements the bargaining power of a tribe and community will remain strong throughout the negotiating process with the mining corporations.

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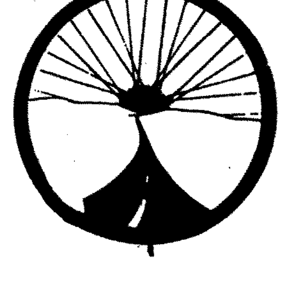
*1121 University Avenue, Madison, Wisconsin, 53715, USA tel 251 7246*



# •ENERGY DEVELOPMENT•

## THE LAKOTA NATION AND THE BLACK HILLS

### ENERGY ISSUES OF THE '80's

Energy development will be one of the most heated controversies of the decade. The Black Hills of South Dakota represent the growing conflict between those who want to develop America's natural resources and those who would preserve them. Add to this conflict the special concerns of The Lakota people and this region illustrates what is occurring throughout the Western United States.

Rising from the flat, dry land which surrounds them the Black Hills span the western edge of South Dakota. Beneath the hills lie significant deposits of uranium, oil, gas and coal. Many of these resources are on federal land.

New U.S. Department of the Interior policies encourage widespread exploration for energy minerals on public lands. Many Americans are concerned about the repercussions of such rapid development in wilderness areas while demand for domestic sources of energy continues to grow. This program examines these and other issues in an hour of absorbing and interesting radio.

### NEW PERSPECTIVES

Since vast amounts of energy resources lie under Indian territory, it is necessary to consider the effects of development on the Native people. This documentary features the perspective of American Indian culture, tradition and relationship to the land--an unfamiliar viewpoint which is of interest to many Americans.

The Lakota Nation, known to most Americans as Sioux Indians, have inhabited the Black Hills region for centuries. Their concerns about development exemplify the concerns of Indians in other energy-rich areas.

### THE ISSUES

The important decisions regarding the development of our energy resources will affect all Americans. The nation must address the same questions which the people of South Dakota are now asking.

WILL ENERGY DEVELOPMENT SCAR THE LAND AND DESTROY WILDERNESS AREAS?
HOW CAN WE MINIMIZE FOREIGN CONTROL OF OUR ENERGY SUPPLIES?
DON'T WE NEED MORE EXPLORATION TO MEET AMERICA'S ENERGY NEEDS?
WILL DAMAGE TO THE WATER IN THESE AGRICULTURAL AREAS AFFECT OUR FOOD SUPPLY?

Local concerns common to mineral-producing states include: the need to expand the economic base of their community, possible health hazards connected with uranium mining and milling and a fear of boom-town economy.

Our program explores the issues using interviews and speeches by Indians, ranchers, development corporations, environmentalists, government agencies and others. This material is presented in a radio program alive with vivid sound, intense emotions and concise information. Listeners gain a better understanding of the issues connected with energy development and how it affects their lives.

### PROGRAM AVAILABILITY

This program can be used for broadcast or non-broadcast use. There are some broadcast restrictions, so each air date must be arranged with the producers. The one-hour monaural program is available through the scheduled satellite transmissions and on audio tape. Included with the program is an audio promotion piece and photo-ready newspaper copy.

Produced by T.J. WESTERN and DAVID McKAY with funds provided by CPB through National Public Radio's Satellite Program Development Fund.

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URANIUM MINING:

papers from the International symposium on Management of Wastes from Uranium Mining and Milling, Albuquerque New Mexico, U.S.A. 10-14 May 1982:

" Geomorphic Hazards and Uranium-Tailings Disposal" - S.A.Schumm, J.E.Costa, T.C.Toy, R.F.Warner. from the Universities of Colorado, Denver, Wisconsin, and Sydney,N.S.W.

" Criteria for the Long Term Management of Uranium Mill Tailings" - R.M.Fry
Office of the Supervising Scientist, Sydney, Australia

" Physico-Chemical Processes in Uranium Mill Tailings and Their Relationship to Contamination" - G.Markos, K.J.Bush, Geochemistry and Environmental Chemistry Research, Inc. South Dakota, U.S.A.

" Radionuclides in Process and Waste Streams at an Operating Uranium Mill" -
R.J.Ring*, D.M.Levins*, F.J.Gee#
*Australian Atomic Energy Commission Research Establishment,Sydney
#Queensland Mines Ltd, Darwin

" Regulation of the Management of Waste from Uranium Mining and Milling in Australia" - R.M.Fry, Office of the Supervising Scientist Sydney and I.W.Morison, Department of National Development and Energy, Canberra

" An Ecological Approach to the Assessment of Vegetation Cover on Inactive Uranium Mill Tailings Sites" - M.Kalin and C.Caza from Institute for Environmental Studies, University of Toronto, Canada

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Bibliography/Literature Review - British Columbia Medical Association (54 articles)

HEALTH

"Birth Effects in Areas of Uranium Mining" - William Wiese M.D.,M.P.H. Department of Family, Community and Emergency Medicine, University of New Mexico School of Medicine, Albuquerque (October, 1981) - paper presented at Radiation Hazards in Mining International Conference

"Lung Cancer Among Navajo Uranium Miners" - L.S.Gottlieb, M.D.,F.C.C.P. and L.A.Husen, M.D. (Reprint from'Chest' Vol 81, April 1982)

"Navajo Uranium Operations: Early Hazards and Recent Interventions" -
H. Tso, Navajo Environmental Protection Commission, and
L.M Shields, Navajo Community College (Reprint from Journal of Science, New Mexico, Vol 20, No 1, June 1980)

"Summary of Major Points made in Royal Commission of Inquiry: Health and Environmental Protection :Uranium Mining - British Columbia Medical Assn. - Relating to Health Effects of Radiation in Uranium Mining" - prepared by E.R.Young,BSc,M.D.

"Birth Anomalies Among the Navajo in the Shiprock, New Mexico, Uranium Mining Area" - Lora Mangum Shields, Navajo Community College, Shiprock N.M.
a review of hospital records 1964-79

Transcript of Meeting held February, 1981 Albuquerque, New Mexico on "Birth Effects in the Four Corners Area" papers include:
Environmental evaluation, Sex ratio patterns, Semen analysis among Uranium miners, Congenital anomalies.

# GROUND FOR CONCERN

RISK ANALYSIS OF RADON 222
FROM URANIUM WASTE TAILINGS.

K Nienhuys, P.A. Okken, Groningen, the Netherlands, 1980.

*This article first appeared in the scientific journal Intermediar in 1980. Lin Pugh translated it.*

In recent years the desirability and need for energy derived from nuclear power to create electricity has been frequently discussed. In the Netherlands a "Broad Social Discussion" is taking place at this point in time on the subject. Up until now little attention has been paid in these discussions to the effects of uranium mining on public health. That is what this article concentrates on.

INTRODUCTION

One of the main problems of the large scale application of nuclear energy is an unavoidable and irreversible increase of radioactivity in the biosphere. Because of the long duration of some radioactive substances their effect on public health will last a long time -- long after the application of splitting atoms to make electricity is a thing of the past. The waste of nuclear power plants, which is discussed at length in the Netherlands, forms a part of this problem. This article is about another form of waste in the nuclear chain: the waste remaining after uranium is mined. In the Netherlands this subject has had hardly any attention, probably because uranium is not mined in this country.

We will show in this article that the effects of uranium mining wastes stretch beyond country boundaries, and last a long period of time.

In risk analyses in which the fossil fuel cycle and the atomic cycles are compared, mostly one figure is given for the quantity of negative affects on public health caused by any one activity. Through this, the fàlse impression is given that such figures are reasonably reliable and acceptable. In this article we present uncertainty margins in our estimate of the number of negative effects on public health through radon emission from uranium mining wastes. We have made this estimate on long and short terms, in the United States and in Europe. In Europe, there are no other estimates in the available literature.

RADON FROM URANIUM WASTES

Uranium is the fuel of nuclear power stations and nuclear bombs. In pure form uranium is a metal. It is found in the ground as ore which contains extremely small amounts of uranium. Directly after the mining it is taken to be processed into a product which contains 70% uranium. This product is basically uranium oxide and is therefore mostly called "yellowcake".

After the yellowcake has been extracted a mountain of ore wastes remains which is, sadly enough, about the same volume as it was when still in the ground. The waste is most often deposited above ground level. Radon gas escapes from this mountain of wastes and gets into the air -- when people breath radon gas in, lung cancer is the result. To understand where this waste comes from we will first tackle the subject of radioactivity and the decay process.

THE DECAY OF URANIUM

All substances are made of atoms. Every atom belongs to a certain element. For example the element hydrogen (H), oxygen (O), uranium (U), etc.

Not all atoms belonging to a certain element are equal. From many elements you find atoms with different atomic masses. These are called isotopes . For example, in natural uranium you find the following isotopes: uranium 238 (99.28%), uranium 235 (0.72%), uranium 234 (0.006%). The greatest amount of natural uranium therefore is made of atoms with atomic mass 238 (uranium 238).

Uranium is not a stable element. It is radioactive. Through the process of radiation an atom decays to an atom of the same element with a lower atomic mass or to an atom of another element. This newly created atom can also be radioactive and in the course of time decay. When in this way a whole series of atoms are created you talk about a decay chain.

The decay chain of the isotope U238 is important.

In table 1 you see that the decay process begins with uranium 238 and ends at lead 206. Of the different isotopes, the half life is given. This is the time in which the quantity of atoms is half the orginal quantity, due to radioactive decay. Which in effect means that if an element has a half life of 2 days, in four days you will have one-quarter the original quantity, and so in.

The thirteen middle products in the decay line have a half life which is much shorter than that of uranium 238. Therefore a balance is achieved in the decay line in the course of time. Every second, for example, a certain quantity of thorium 230 (from U234) comes into existence and per second thorium decays (to radium 226). The total quantity of thorium 230 remains, therefore, the same. This is called "secular balance".

A quantity of uranium ore which exists for several thousand years undisturbed under the ground will have a characteristic level of middle products of the decay chain (these isotopes cannot come into being any other way).For isotopes with a short half life this level is very small. The characteristic level is larger for uranium 234, thorium 230 and radium 226.

In the production of yellowcake a chemical extraction technique is used in which selective uranium is extracted from the ore. Through this the middle products originally in the ore (thorium 230, radium 226, etc) get into the waste mountain. Because these middle products, like uranium, are metals, they will remain in the waste mountain under normal circumstances. But there is one deviant: radon 222. This is a noble gas and can therefore escape the tailings pile and enter the atmosphere, through emission.

In the wastes, called tailings, there is also a secular balance regarding radon 222, so that a constant amount of radon 222 exists at any one second. In principle the radon emissions can continue until the "parent" in the decay

TABLE 1 DECAY CHAIN OF URANIUM 238

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| uranium 238<br>4.5 x $10^9$ years | $\xrightarrow{\alpha}$ | thorium 234<br>24.1 days | $\xrightarrow{\beta}$ | paladium 234<br>1.17 minutes | $\xrightarrow{\beta}$ |
| uranium 234<br>2.5 x $10^5$ years | $\xrightarrow{\alpha}$ | thorium 230<br>76,000 years | $\xrightarrow{\alpha}$ | radium 226<br>1600 years | $\xrightarrow{\alpha}$ |
| radon 222<br>3.82 days | $\xrightarrow{\alpha}$ | polonium 218<br>3.05 minutes | $\xrightarrow{\alpha}$ | lead 214<br>26.8 minutes | $\xrightarrow{\beta}$ |
| bismuth 214<br>19.7 minutes | $\xrightarrow{\beta}$ | polonium 214<br>1.62 x $10^{-4}$ seconds | $\xrightarrow{\alpha}$ | lead 210<br>21 years | $\xrightarrow{\beta}$ |
| bismuth 210<br>5.01 days | $\xrightarrow{\beta}$ | polonium 210<br>138.4 days | $\xrightarrow{\alpha}$ | lead 206<br>stable | |

Radioactive decay is shown with an arrow. The half life of each product is given, as is the sort of radioactivity the product has. $\alpha$ radiation (2 protons, 2 neutrons) or $\beta$ radiation (electrons).

line, thorium 230, is totally decayed.Thorium 230, however, has a very long half-life: 76,000 years. So to expect the end of radon 222 you will have to wait for 76,000 years- and then you have only gotten to half the time it will take to go.

Not all the radon 222 formed in the tailings pile escapes. The gas takes some time to get from the place where it is made to the surface. Because radon 222 has a half life of 3,82 days, it can happen that the radon 222 is already decayed before it gets to the surface.

In the methods of tailings storage used normally , only several percent of the radon will escape. Exactly how much will escape depends on the combination of which method of storage is used, and the storage site. We will first look in more detail at the methods of storing uranium mining wastes.

URANIUM TAILINGS

Uranium mining has a short history. It is really only since after the second world war that uranium mining has become an industry, particularly in the United States. The principle mining area was used in the early years almost entirely for making nuclear weapons. From 1974 the annual use of uranium for civil purposes (electricity generation) exceeded for the first time military use. [11]

One half of the uranium ore is mined in open mines, the other half underground. In Europe mostly underground mining is used (France, Czechoslovakia). In less thickly populated regions (Namibia, North Australia) uranium is mined in open pits. Using open pit mining is only feasible up till a certain depth. To keep the transport costs as low as possible the mill, or extraction factory, is usually as close as possible to the uranium mine.

In the early period of uranium mining little interest was shown in the uranium tailings. This was thrown onto piles near the mill. The tailings pile is mostly fine sand and is therefore an attractive building material. As such it has been used for, amongst other things, road construction and the foundations of houses and buildings. In the American town of Grand Junction hundreds of houses have been built using tailings sand. In 1965 the practice was stopped in that city - it was feared the sand could endanger public health. When it was later realised that the radiation concentrations in these homes were far too high, the floors were torn out, and new foundations were laid. This work was begun in 1973, and is still to this day being worked on.

TABLE 2 URANIUM PRODUCTION IN WESTERN COUNTRIES

Production (tons uranium)

| Country | 1976 | period before 1976 |
|---|---|---|
| United States | 9800 | 199900 |
| Canada | 4850 | 107180 |
| South Africa and Namibia | 3410 | 72570 |
| France | 2060 | 24180 |
| Zaire | -- | 21600 |
| Australia | 360 | 7080 |
| Other countries o | 2740 | 14960 |

o In order of production in 1976:
Gabon, Nigeria, Portugal, Malagasia, Spain, Argentina, West Germany, Sweden, Japan, Mexico, India.

Source: OECD NEA/IAEA: Uranium, supply and demand 1977 en earlier reports.

(editors note, there has been a more recent OECD report with more up to date figures).

At about this same time people began to realise that radon emission from the mountains of tailings is a public health danger. The first report on that dates from 1973.[1] The mountains of tailings are susceptible to erosion. The fine sand easily blows away and slides of the piles often occur. When the pile becomes wet poisonous substances (heavy metals) leach out and reappear again in drinking water.

Because people gradually became aware of these problems, better storage methods were sought. The only method which also limits the long term dangers of uranium tailings is underground storage. For example, through putting wastes back into the mine. When uranium ore is mined underground, only a small percentage of the tailings can be put back into the earth. In France, for example, it cannot be used as support material in the mines because of bad mechanical characteristics. When the underground mine stops, the volume of the mine is always lessened - shrinking, sinking etc. The mine also becomes partially filled with water.[12]

When uranium ore is mined in open pits, returning the wastes to the mine is realistic. In open pit mining a layer of stone is first removed before reaching the ore. In the resulting hole there is later enough space for the tailings. In this way the uranium in Northern Australia will be, after 20 years (when the mining is complete) put back and covered with inert stone.[13]

It is the general practice to store above-ground waste in the form of a plateau. Attempts to stabilise this plateau by covering with asphalt layers or through planting has brought no success. The asphalt layer split and broke up Very few plants are willing to grow on sand in a dry climate.

Another form of storage is the conical form. Propagandists of the cone form claim that the structure is less sensitive to erosion because there are fewer steep rises and because no pit can form at the top. The problem of leaching by heavy metals is then supposedly overcome by having several retention ponds in which the water which has dripped away accumulates and in the course of time the heavy metals accumulate on the pond floor. The tailings can also be stored in a basin. It is mixed with water and stored in a walled area. The pros of this is that the tailings are less sensitive to erosion and that the water above the tailings stops radon emissions. One thing against it is the extra costs involved in building and maintaining the walls. maintenance is necessary because of the danger of the wall breaking. In July 1979 for example the wall of the tailings basin at Church Rock, New Mexico, broke, and 1100 tons of radioactive tailings and 400 million litres of water flooded into the Rio Puerco.[14] If a basin is not constantly replenished with new wastes it will dry out because the water evaporation is high and other water escapes underground. In that case there is no difference between plateau and basin storage once the company has packed up and gone home.

In all this it is important to remember that large quantities of radioactive wastes are involved. To give an impression: to have the nuclear power plant at Borselle functioning at full power for 1 year, 90 tons of uranium are needed. In the mining of this, 30,000 $m^3$ waste is created when we assume that the uranium level in the ore is 0.2%. As time goes by the percentage of uranium in the ore is getting poorer, so the example is not at all an exxageration. In the United States the average uranium content level is 0.15% and in the near future it looks like ores with 0.03% will be mined.[15] In that case, to service Borselle, 200,000 $m^3$ radioactive wastes will be created annually.

LUNG CANCER THROUGH RADON

After emitting from the tailings pile the radon comes into the atmosphere and is caught on the wind. In this way it can be breathed in by the general public. As the half life is 3.82 days, radon gas carried on the wind can travel large distances and reach thickly populated regions.[16]

Lung cancer arises from damage to lung tissue. We understand that lung cancer particularly is created then when alpha radiation strikes the kernel of the cells from which the lung epitelium is formed. (basal cells, see figure 2)[4] When someone breathes in radon gas, the chances increase for contracting lung cancer. This is not caused by the radon itself: radon is an inert gas and is not held in the lungs once breathed in. The risk comes from the "short lived daughters" of radon 222; these are the isotopes polonium 218, lead 214, bismuth 214, and polonium 214 all of which have a short half life (from 162 microseconds to 27 minutes, see table 1).

The short lived daughters of radon are formed as ions. After being breathed in, free ions are held captive in the air passages, partially in the lungs which are most sensitive to radiation. Free ions are extremely reactive and the most short lived daughters will quickly unite with dust particles in the air (aerosols). When an aerosol is breathed in there is a certain chance that it will be held in the lungs. This chance depends on the size of the aerosol: the smaller the aerosol, the greater the chance of being held captive in the lungs.

The short lived radon daughters which are captive in the lungs can damage the lung tissue through radioactivity, which they emit. Most dangerous here is the alpha radiation from polonium 218 and 214. This radiation has a minimal depth (no more than 70 micro meter) but is extremely energetic.

When tissue receives a certain amount of radiation, a radiation dose is referred to. Radiation doses are expressed in the quantity "rem". This tells how much radiation energy per gram tissue is absorbed, multiplied by a quality factor according to the sort of radiation.

A radiation dose can be calculated when the exposure to radon gas is known. It is difficult, however, to calculate the radiation dose which the basal cells of the lung epitelium receive when the short lived radon daughters are inhaled. In the literature various conclusions are reached. The calculated radiation doses (with the same exposure) differ by a factor of 60 from each other.

To estimate the number of deaths in a whole population as a result of lung cancer caused by a certain quantity of short lived radon daughters is difficult. The problem can be avoided by basing figures on actual figures from the quantity of deaths from lung cancer of mine workers. One can make a direct link between exposure (retention of short lived daughters) and effect (lung cancer).

## LUNG CANCER AMONG MINE WORKERS

In uranium mines and in other mines which have uranium bearing rocks, high concentrations of radon and its short lived daughter products float into the air. The existence of lung cancer deaths in these mines is a well known fact from long ago: in the silver mines of Jachymor (Joachimsthal), people since the 15th century have called

(Alschuser)

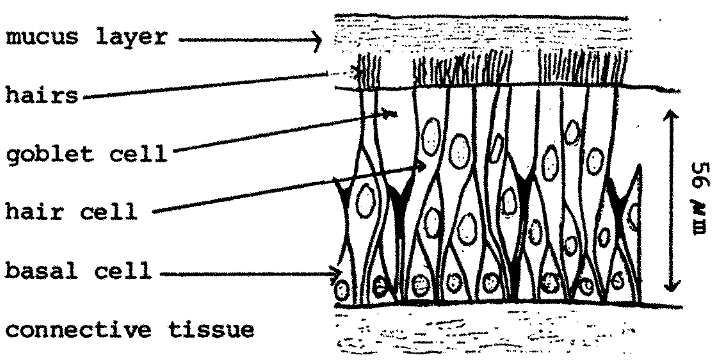



Figure 2. Crossection of the lung epitelium according to Altschuler.

Source: B Altschuler, Health Physics 10: 1137-1161 (1964) this illness "mountain sickness". The uranium mineral pitchblend was found in these areas. At that time it was a useless mineral, and was thrown on the wastepile beside the mine. The black piles of pitchblend were a curiosity because they lit up at night.

There have been many times when mountain sickness was the cause of death of half the mine workers.

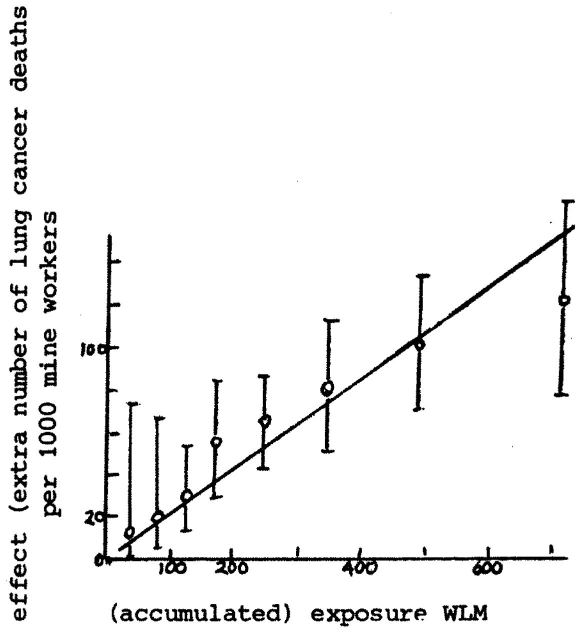
After mountain sickness was diagnosed in the 1930's as lung cancer epidimilogical research of this work-related illness was begun. For this research, groups of miners were chosen who had been exposed to high concentrations of the short lived radon daughters. In this way six groups of mine workers were investigated, namely in Newfoundland (Canada, 630 mineworkers), England (500 mineworkers), Sweden (4866 workers), U.S.A. (3366 workers), Czechoslovakia (more than 3400 workers) and Ontario (Canada, 7000-8000 mineworkers).

The result of these investigations differ. The differences in results can be written down to inadequate measurement programmes (measurement of the concentrations of short-lived radon daughters in the mine air), dubious diagnoses and in some instances the short time between exposure and research (the average latency period of lung cancer is 20 years after exposure).

In these investigations people looked for a direct link between exposure and effect. The mineworkers were divided into groups according to the amount of short-lived radon daughters they had breathed in. From each group the extra number of deaths from lung cancer were checked. By extra, they meant more than what would be expected on the grounds of age, smoking habits, etc. The results were expressed in a so-called "exposure effect curve".

On the basis of our evaluation, the Czech and the Ontario research are the more trustworthy. The report of the "United Nations Scientific Committee on the Effects of Atomic Radiation" (UNSCEAR Report), 1977, also supports this conclusion. 4

fig 3. "Exposure Effect Curve for Czech Mineworkers"
source: Sevc et al, Health Physics 30:433-437 (1976)




In figure 3 the inhaled quantity of short lived radon daughters is expressed in the special entity WLM. The blocks express the 95% certainty interval.

For the Canadian uranium workers (Ontario) no exposure effect curve has been produced. The results till now indicate a curve similar to that in the Czech research.

To what extent can we now use the now recognised link between exposure and effect for mineworkers to calculate the effect of exposure to radon and its daughters for the general public.

Two problems arise: the exposure is for individual members of the population less than for the mineworkers and the nature of exposure is variable.

The straight line in figure 3 drawn between the measurement points, reflects the point that there is a linear connection between exposure (compared with the dose resulting from this) and the damage resulting from radiation. One usually assumes these days that the line cannot be drawn through the zero point. That is to say, for a low radiation dose (members of the public in this case) the same, constant relationship between dose and effect will apply as for higher radiation doses (mineworkers), In the National Academy of Sciences of 1979 the majority of the Committee on the Biological Effects of Ionising Radiation (BEIR) put forward that the application of a linear dose-effect relationship would not overestimate the effect of a lower dose. This is a controversial question. On the one hand for example, a minority of the BEIR Commission is convinced that a low radiation dose does not have a relatively lesser effect. On the other hand more recent information indicates that lower radiation doses may have in fact more effect than one could expect on the basis of a linear dose-effect relation would have you believe[19] Archer, who has done a lot of research on mine workers, believes that the use of the linear hypothesis absolutely underestimates the risk of lung cancer as a result of lower doses of radiation from the short lived radon daughters[20] We also choose a conservative approach by assuming a linear connection between dose and effect. Up until now we have only talked about the exposure of mineworkers, not about the dose of the exposure. The reason for this is that the mine air has a different composition than air outside the mine. The estimation of exposure to mine air in an absorbed dose for mineworkers differs also from the calculated dose members of the public receive who live some distance downwind from the tailings pile. We will shortly return to this point.

RISK ANALYSIS

In the above a qualititive description is given of the problem of radon emission from uranium waste tailings. We are also interested in a quantative description. This is important in comparisons of the damage to the public health resulting from the different forms of electricity production.

In the U.S. more attention is being given to the dangers of radioactive waste tailings. In the course of time three scientific reports have appeared on this subject (1,2,3). In these reports an estimate is made of the number of deaths from lung cancer caused by radon emission during a certain period of time (one year) from the quantity of uranium necessary to produce a certain quantity of electricity ($8.76 \times 10^9$ kwh)[21] To present one figure for the estimate you will give the appearance of relative precision. Yet three different American reports have arrived at three different estimated figures. The estimate of one report is a factor of 10 higher than a second figure. The third figure lies somewhere between the other two. These differences can be put down to "scientific uncertainty". Many figures which are necessary for the estimate are not known with any certainty so guesses are made.

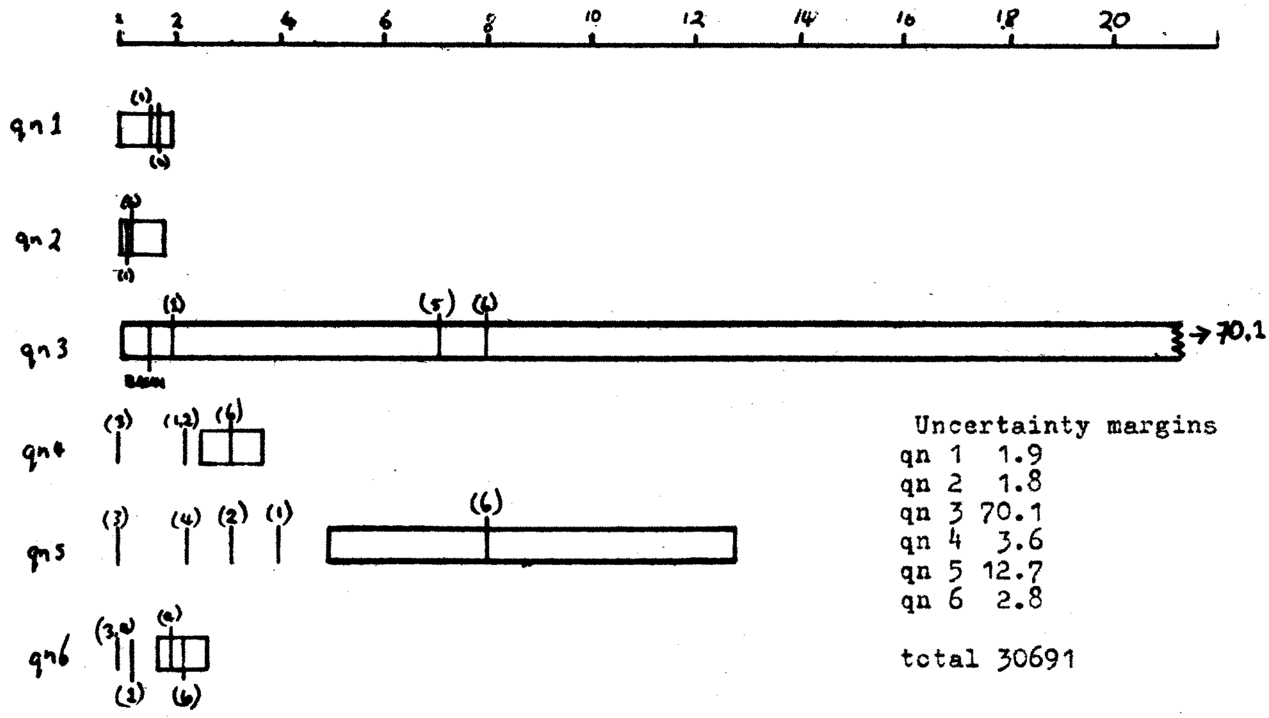
UNCERTAINTY MARGINS

In the risk analysis the question is: how many people within a certain period (one year) will die from lung cancer because they have inhaled radon gas coming from uranium tailings piles resulting from the amount of uranium mined to produce $8.76 \times 10^9$kwh electricity? The answer to this question can be found via the answers to six consequative questions:

1. How much uranium is necessary to produce $8,76 \times 10^9$ kwh in a nuclear power plant?
2. How much radium 226 is present in the tailings of this quantity of uranium?
3. What radon emission causes this amount of radium 226 per year?
4. What is the public exposure (through inhaling the short lived radon daughters) as a result of this radon emission?
5. How great is the total radiation dose (in the lung epitelium) caused by this public exposure?
6. How many lung cancer deaths result from this radiation dose?

The answer to each question is a premise with an uncertainty margin. The product of the six premises produces the answer to the original

Figure 4. Comparison of premises for the six questions in the risk analysis. The lowest premise is set at one. the numbers in brackets refer to the literature list.




question. The uncertainty in each premise has been found through identifying the minimal and the maximal possible premises. The relationship between the largest and smallest value is the uncertainty margin.

The figures for this analysis are deduced from the technical and scientific literature. Besides that we have further refined some of the estimates of some premises by bringing in more variables. From the combination of all the figures we conclude that the uncertainty margin in an estimate of the amount of deaths from lung cancer each year per quantity of electricity produced has a factor of 30,000. For every premise we present in figure 4 a maximum, minimum and reasonable estimate shown as a striped line(6), as well as other premises mentioned in the literature(1,2,3,4,5). All values are normed at the least value.

We will now look at the six questions in which scientific uncertainties play a role in ascertaining the effects of emission of radon from uranium tailings on public health.

SCIENTIFIC UNCERTAINTIES

1. In reckoning the quantity of uranium necessary for the production of 8.76 x $10^9$kwh in a nuclear power plant we assume we are talking about a light water reactor, because more than 90% of all nuclear power plants are of this type. The necessary amount of uranium varies in the different reports. As you will see in fig 4 the uncertainty margin is a factor of 1.9. The difference can be put down to , for example, the time at which fuels rods are placed in a light water reactor. Other differences have to do with whether or not used fuel rods are reprocessed, and if they are reprocessed, whether only the uranium, or also the plutonium, gets recycled. Finally various premises are made which relate to uranium losses in the enrichment process and in the fuel rod factory.

2. Given the necessary amount of uranium, an estimate can be made of the amount of uranium

ore which has to be mined and the quantities of radium 226 which remain behind in the tailings pile. The estimates differ here by a factor of 1.8.

Important in this are the premises relating to the uranium output at the extraction mill: the present output percentages differ 80-90%. There is also a difference in open pit and underground mining. With open mining large quantities of rock have to be removed; in some cases these rocks themselves contain large quantities of radium 226. It is also important whether or not secular balance exists in the tailings, how much radium 226 accidently gets extracted from the ore at the mill, and how much radium 226 disappears from the tailings through erosion.

3. The radium 226 in the tailings decays to radon 222, but as we earlier said, not all the radon gas comes into the air. Estimates relating to the amount of radon emission differ widely from each other, mith maximal a factor of 70.

For our calculations we assume that the tailings are piled in plateau form (see fig 1) because this is representative also for dried-up basin storage and because the minimum and maximum of the conical mountain and the shapeless piles fall within the minima and maxima of the plateau form.

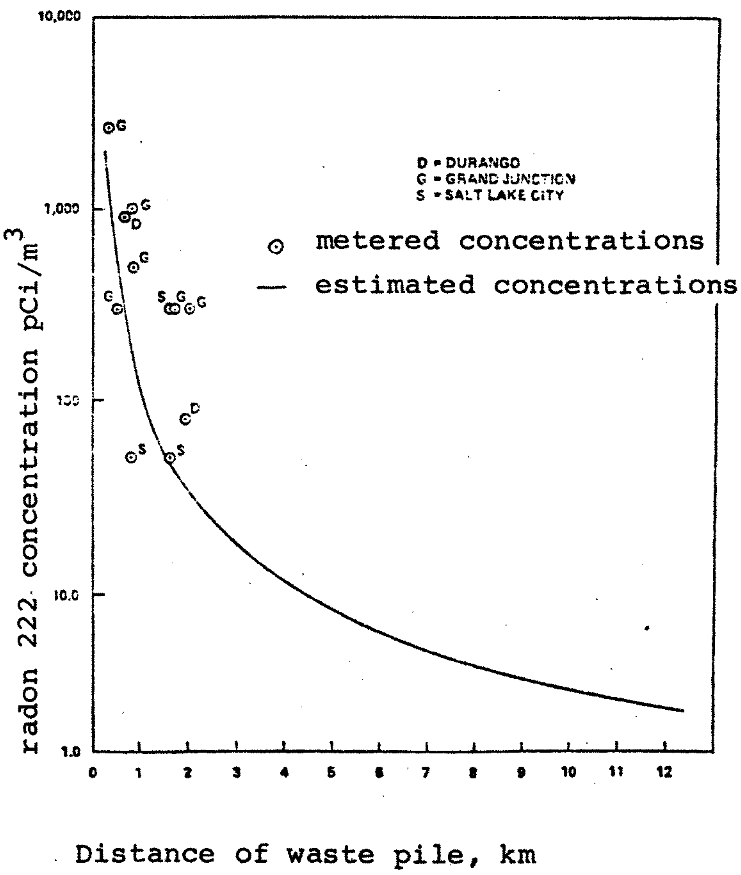
Important is the height of the pile: with a height of 10 meters the amount of radium 226 is 5 to 10 times lower than by the height of 1.15 metres, as a result of the radioactive decay of the radon which in the first example has to travel further to reach the atmosphere. For the same reason the composition of the tailings pile is important: the size of the particles, the wetness, the compactness and the geological age of the rocks In addition the effect of the height of the plateau on the radon emission from one sort of transport mechanism (molecular diffusion) is calculated. Besides this one can also take into account transport through water and through convection. The combination of all these factors leads to the minimum and maximum radon emissions such as are presented in figure 4. The premises which lie between deserve some explanation. The figure which we obtained from reference 5 is calculated from 22 existing, abandonned uranium tailings piles in the U.S. with an average height of 5.25 metres. This calculation is partially supported by field measurements of the radon concentrations in the air around three of the piles. The results are shown in fig.5.

The model calculations in ref (1) were made in 1973. Since then a lot more is known about the influence of height and the composition of the wastes on radon emissions.

Given that there is not much known about emission of radon from basin tailings and that empirical facts do not exist, one can only make an average guess in the figure 4 scheme.

Fig 5. Measured and calculated radon 222 concentrations in the air around 3 uranium tailings piles in the U.S.

source: ref 5.



4. On the basis of a certain radon emission one can calculate the public exposure. The uncertainty margin carries in the case of the U.S.A. a factor of 3.6.

The three premises in the scheme ((1,2),3,6) are derived from the following method. First a calculation using a meteorological model is made at different distances from the source of radon emission (the tailings pile) to determine the radon concentrations in the air. Here the important variables are the direction of the wind, the speed of the wind, and the height of the mixing layer in the atmosphere. When these calculations of radon concentrations are combined with regional population concentrations in the U.S. an estimation can be made as to the exposure of the U.S. public. The outcome of this calculation in reference (1,2) is a factor of 2 higher than the calculation in ref (3). The result of the calculation we did together with G. van Dijk lies somewhere between the two calculations. We describe in reference 22 the meteorological model used in these calculations. *22*

We then corrected our calculation for 3 situations which have not been taken into account in the other three calculations. A radon emission on American soil can also cause public exposure to radon 222 outside the U.S.

If the mine is close to a large city, the public exposure is higher. We have also taken into account that radon gas spreads in the atmosphere according to hydrostatic balance. We include the fact that the pressure of a gas decreases as the height increases. Therefore close to earth one finds more radon than is expected by uniform spreading in a mixing layer at a certain height.

5. When the amount of short lived radon daughters inhaled by a population (exposure) is calculated, a radiation dose of the whole population can be assumed. Considering that from our evaluation the epidemological research of the lung cancer deaths of Czech mine workers appears the most reliable, we have taken this as a starting point. In this research one used a certain connection between the exposure of uranium mine workers and the radiation dose. To correct this connection for the difference between exposure of the public in general we used, among other things, the same methodology as the UNSCEAR report. *4*

The UNSCEAR report uses only one correction, namely a correction for decreased breathing. Mineworkers breathe in 20 litres of air per minute, while the general public usually breathes in 15 litres per minute. Therefore the radiation per individual of the public at a certain concentration of short-lived radon daughters in the air is 25% less than for mine workers.

There are other differences as well. We have used four other corrections. The most important are the corrections for differences in aerosol size and for the creation of free ions. The short lived radon daughters mostly attach themselves to aerosols. From measurements it appears that the average aerosol size in normal air is a factor of 2-6 smaller than in a mine. The smaller aerosols have a higher chance of remaining in the lungs after inhalation; therefore we assume the public radiation level will be relatively higher. Further a small part of the short lived radon daughters do not attach themselves to aerosols but float as free ion in the air. As we have already stated some free ions remain in the lungs after inhalation. In normal air relatively more free ions appear than in mine air. This means that with respect to this factor public radiation doses will be higher than mine doses.

Two other less important corrections need to be taken into account, namely corrections for the difference in decay-balance and for the difference in the sort of breathing.

Our estimate and its uncertainty level is shown in figure 4. You will see the premises of the reports are excluded (1,2,3,4). In these reports our corrections have not been taken into consideration.

6.Now that the population radiation dose is known we can make an estimate of the number of deaths from lung cancer resulting from this.

As we said, the Czech exposure effect relationship has been used. This group of mineworkers is not representative of the population as a whole. The average lifetime of the public is for example somewhat less than that of the Czech mine workers. According to the UNSCEAR the population effect relationship can thereby be reduced by a factor of 2. We have developed the correction for age difference somewhat more and have given next to that a correction for possible other effects of exposure to short lived radon daughters (for example the effect of death through metastase of lung cancer) and a correction for the fact that uranium mine workers could get lung cancer from breathing in radioactive dust.

RESULTS OF THE RISK ANALYSIS

In the preceding we have discussed the six steps taken in making a calculation of the effects of radon emission from piles of uranium waste tailings. The uncertainty margin in the final analysis is caused by some 40 physical, chemical and medical factors which can be interpreted in different ways. For a more detailed discussion one can read the authors full thesis paper.[6]

As the 6 steps can be independent of each other we can combine them in the total estimation of the number of deaths due to lung cancer per year per $8.76 \times 10^9$kwh. In table 3 we give total estimates of maximum and minimum for these. The uncertainty margin takes a factor of 30,000 for the U.S. In table 3 a "realistic" total estiamte is given. We have taken the following premises to reach this figure:

1. no recycling of used fuel rods
2. underground uranium mines
3. field results of present talings storage in the U.S.

4.5.6. the average of the determined maximum and minimum.

The calculations relate to the situation in the USA. Uranium is mined in other countries. France has more uranium than necessary for its own use. We have therefore in the same way made a calcualtion for radon emission from uranium tailings in France. The total estimate comes to a factor of 6 higher than the case of the U.S. The difference is the larger population density in Europe. With this total estimation for France we have assumed that the other premises are identical to those in the U.S. For the realistic premise for the third of the above, it is true in the case of France that climate could make a difference. The French climate is better at repressing radon emission, for example through planting. This also becomes more necessary, considering the higher population density in Europe. It is questionable whether this will be realised, however.

table 3

TABLE 3: Total estimate of the number of deaths from lung cancer as a result of one year radon emission from uranium waste tailings for $8.76 \times 10^9$ kwh laying in the United States or France.

| | U.S. | France ● |
|---|---|---|
| realistic estimate | $7.5 \times 10^{-2}$ | 0.45 |
| maximum | 2.7 | 17 |
| minimum | $8.8 \times 10^{-5}$ | $1.2 \times 10^{-3}$ |

deaths per year and per $8.76 \times 10^9$ kwh

● about 35% of this quantity of deaths would be residents of France

## RISKS ON THE LONG TERM

Until now we have only discussed radon emissions lasting one year. As we said radon emissions can last much longer. In principle the radon emission can continue until all the thorium 230 (the left behind "father" metal) in the waste has gone. Seeing as the half life of thorium 230 is 76,000 years that will take several thousand years before (almost) all the thorium 230 has decayed. This means that the problem of uranium tailings is principally a problem for future generations. In table 4 we make estiamtes of the number of deaths due to lung cancer per 8.76 x $10^9$ kwh on the (medium) long term.

In the estimate in table 4 it is assumed that all circumstances in the course of time remain the same. When we take a longer period into consideration, however, there are numerous possible factors which could decrease or increase the accumulated number of deaths due to lung cancer.

Despite this extra uncertainty we can now propose that the uranium tailings are potentially a greater danger for the public health. We want to illustrate that using a mathematical example.

The calculation here of the number of deaths from lung cancer in the 21st century as a result of the quality of electricity produced from 1980-2000 in nuclear power plants, and assuming that uranium is mined in France. Of course this is not possible as the reserves in France as not sufficient, but if the other West European uranium reserves are exploited it is possible, in principle.

The problem with this estimate is that the prognoses relating to the use of nuclear power for the rest of this century contradict each other.[23] One of the lowest prognoses (OECD/IEA "Steam Coal" 1978) has a nuclear power capacity of 268 Gigawatt in the year 2000 in Europe (excluding East Block countries).[24] In comparison: in 1979 the potential of nuclear plants was 36.6 Gwe and there were 73.5 Gwe in construction.[25]

If we use this prognoses, between 1980 and 2000 1.75 x $10^{13}$ kwh in light water reactors will be produced in Europe (excluding East Block countries). This amount of electricity will cause 90,000 deaths due to lung cancer from uranium tailings. (see table 5)

## OTHER RISKS

Excepting the possibility of lung cancer through the inhalation of short lived radon daughters, uranium tailings produce other public health risks. In general it is assumed that the here described lung cancer risk is the most dominant. From reference (2) one can also conclude that the accumulation of the long lived daughter products lead 210 in the human body produces a risk of the same order.

TABLE 4: "Realistic" estimate of the quantity of deaths from lung cancer per 8.76 x $10^9$ kwh and different periods of radon emission in the U.S.

| radon emission lasting | U.S. |
|---|---|
| 1 year | 7.5 x $10^{-2}$ • |
| 100 years | 7.5 |
| 76,000 years | 4000 |
| until all the thorium is gone | 8000 |

• deaths per 8.76 x $10^9$ kwh, see table 3

TABLE 5: Estimate of the number of deaths in the 21st century from lung cancer which is a direct result of the production of electricity by LWR reactors in Western Europe in the 20th century, presuming the necessary uranium is mined in France.

| | Western Europe 21st Century |
|---|---|
| realistic estimate | 90,000 • |
| maximum | $3.4 \times 10^6$ |
| minimum | 240 |

• deaths per $1.75 \times 10^{13}$ kwh and per 100 years.

REFERENCES


1. US Environmental Protection Agency. Environment Analysis of the uranium fuel cycle. Part 1: fuel supply. Wash DC October 1973

2. US Nuclear Regulatory Commission. Affadavit to the licensing board hearings on Jamesport plant. March 1978

3. C.C. Travis et al. Potential population dose from radn 222 released by uranium tailings piles. ANS Transactions 30 (1978) p 90

4. UNSCEAR.Sources and effects of ionising radiation. New York 1977

5. US EPA. Potential radiological impact of air borne releases and direct gamma radiation to individuals living near inactive uranium mill tailings piles Jan 1976.

6. P.A. Okken. Risico Analyse van radon 222 uit uraniumertsavfal. Vrije Studie-Richting Sceikunde, R.U. Groningen. Oct 1979

7. Minister van Economische Zaken e.a. Opzetnota. Maatschappelijke diskussie over de toepassing van kernenergie voor electriciteitsopwekking. 16 Aug 1979 p2.

8. Voorlopige Algemene Energie Raad. Kolen en Uraan. Een overzicht van relevante aspekten met betrekking tot het gebruik van kolen/uraan voor elektriciteitsopwekking. 's Gravenhage Aug 1979 p 4.

9. idem p 75

10. NB This is not a work related risk o of uranium miners. Although this problem is also left out of discussions on the coal/uranium question.

11. A. Smith. Military uses of uranium: keeping the U.S. energy accounts, Science 201 (1978) p 609

12. Francois et al. La ventilation dans les mines d'uranium. Proc of a panel, Washington, 1973 (IAEA PL 563/3)

13. Fox et al. Ranger Uranium environmental inquiry. Second report. Australian government publishing service, Canberra, 1977

14.J. Fuerst Not Man Apart Dec 1979

15. O Carlsson, L.A. Noijd. Uranium production from low grade Swedish shale. IAEA Conf Proceedings, Salzburg 1977 (IAEA CN 36/277).

16. With soft wind (5m/sec) the gas can travel 1650 km in 3.82 days.

17. WLM = Working Level Month = 170 hours airborne with a concentration of 100 pCi radon 222 per liter in secular balance with the short lived daughters

18. Science 204 (1979) p 711

19. See for example K.Z. Morgan. The Bulletin of Atomic Scientists, Sept 1978 p 30. And J Rotblat, idem p 42

20. V.E. Archer, quoted in "Health dangers of the nuclear fuel chain and low level ionising radiation". British Columbia Medical Association. Vancouver MC May 1979.

21. $8.76 \times 10^9$ kwh (kilowatt hours) is the quantity of electricity working at full capacity of 1000 mWe for one year produces. In comparison! the nuclear power plant at Borselle (The Netherlands) of 443 mWe worked to 81% in the period 1975-1978. This plant therefore produces about $3.4 \times 10^9$kwh annually.

22. G. van Dijk. W. Smit. Kleine kansen, grote gevolgen. Boerderijcahier T.H. Twente 1976.

23. H. Hoog. The Nuclear Option: a long term investment. Energiespectrum 7/8 (1979) p 182.

24. 1 GWe = 1000mWe

25. Neue Kernkraftwerke in Europa 1979 (Teil II) Atomwirtschaft 5 (1979) p 262

# Churchrock

"CHURCHROCK" _ AN UNRESOLVED DISASTER

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July 16 1982 marks the third anniversary of the United Nuclear Corporation's (UNC) uranium tailings spill at Church Rock, New Mexico, located on the Navajo Reservation. That spill released approximately 95 million gallons of radioactive liquids and over 1,100 tons of radioactive sludge into the Rio Puerco River of the West, which flowed past Gallup into Arizona. The spill was a combination of design defects and lack of appropriate maintenance by UNC.

According to Southwest Research and Information Center, an Alberquerque public interest group which presented testimony on the spill before Congressional Hearing, "The Churchrock accident is rated as the largest radioactive materials spill in the history of the United States." Although much data has been gathered over the past three years, two members of Southwest Research feel that many health and environmental issues remain unresolved.

"Many important lessons have been learned from the Churchrock spill which may help prevent similar accidents in the future, provide tighter regulations and oversight over uranium activities, and ensure more effective emergency response and cleanup," said Lynda Taylor, with Southwest Research's Radiation and Health Project. "However, in the case of Churchrock, buraeucratic foot-dragging and industry indifference have left a number of issues unresolved." She added, "This is evidenced by the fact that radioactive and other contaminants continue to seep from UNC's tailings impoundment into nearby groundwater, many radioactive "hot spots" along the Puerco from the spill have not been cleaned up, and the Churchrock community has not been followed up by any health study."

Taylor pointed out that "More is known about the increased rate of still births and birth defects in the Churchrock livestock born after the spill than is known about the community residents themselves. I believe that a birth registry which records Churchrock community births prior to, during and after the spill is absolutely necessary to help us understand the potential health risks this community may face. The data could be collected within a relatively short period of time, and you would not have to wait out the long latency period as is the case with a cancer registry, to find any effects."

"Up until now," Taylor continues, "Health assessments have been made for cancers only, using radiation risk models which have been under serious debate as inadequate. The unborn child is by far the most sensitive to the effects of radiation or any carcenogen, and hence would be a more appropriate population to study for any health changes since the spill."

Chris Shuey, a member of Southwest Research's Water and Mining Project, elaborated on the contamination problem that currently exists at UNC's tailings site. "Seepage persists from the UNC tailings dam, possibly onto Indian allocated lands east of the site. This represents contamination of someone else's limited groundwater supplies and potentially violates the state's groundwater protection regulations. The state should more closely monitor UNC's efforts to assess the spread of this off-site pollution and where necessary demand that contaminated waters be restored to their original condition."

Shuey believes an expanded state water monitoring programme is necessary to determine the long term impacts of the spill. "This year, the Environmental Improvement Division (EID) installed additional groundwater monitoring wells along the Puerco to assess the long-term impacts of the spill. This program should be expanded, with the cooperation of Arizona officials, to include the Lupton-Houck area just inside the

Arizona border. This area was identified by U.S. consulants in late 1979 as one of only two ground water recharge zones along the length of the Puerco from Churchrock to Holbrook, Arizona."

Shuey is also interested in UNC abiding by its operating license with the EID which requires UNC to find a new, geologically suitable site for their existing tailings impoundment by November, 1984. Shuey says "UNC was ordered by New Mexico EID in November, 1979 to find a new site for its tailings operation within five years. According to state officials, the company has been closed mouthed about its efforts to find a new site. Since one of the findings of the various post-spill investigations was that the tailings impoundment was improperly constructed in an alluvial channel given to rapid recharge to underlying ground waters, New Mexico EID should more closely monitor and aid UNC in finding a new site and moving its tailings within the next few years."

Southwest Research released its report detailing the major unresolved issues around the Churchrock tailings spill on July 19th. A summary of these issues follows:

1. Neither UNC nor the state have adequately cleaned up the Rio Puerco since the Churchrock spill
2. Radioactive and other contaminants continue to seep into the ground water from UNC's tailings pond at a rate of 15,000 to 80,000 gallons per day.
3. The radioactive Materials License between the state EID and UNC requires a new, geologically suitable site for the existing tailings pile be found by November, 1984. Nothing is known of the UNC's efforts in this regard.
4. Los Almos conducted a study of five Navajo children and one adult believed to have been exposed to the Churchrock spill materials. Joerg Winterer, a prominent Public Health Service pediatrician, had recommended a continued follow-up of these affected individuals. NO such follow up has been planned by Los Almos or health officials.
5. Several health experts have recommended that birth and cancer registries be set up in the Churchrock community. This has not been done.
6. The Indian Health Service, upon recommendations by state and federal agencies, designed a livestock monitoring program for the Churchrock area to determine food chain concentrations of radioactive and other contaminants. This program has not been implemented.

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# Water

## THREATS TO WATER ON THE NORTHERN GREAT PLAINS

*Lilias Jones published an article in the Early Spring issue of Akwesasne Notes, from which the following is exerted. "In the Great Plains and the mountain West, when you refer to the 'energy problem' you are also referring to a water problem". Uranium has a lot to do with the problems arising.*

South Dakotans are discovering pollution problems both from natural contamination and from old uranium operations. Several towns have discovered that their wells are radioactive -- and that there's really no way to remove radiation from the water. Wells in and near Midland and Philip, small towns on the plains, are full of radium. So are two wells on the edge of Rapid City, one of which was closed down. In that case, officials had known of the problem for seven months, but no-one was told until a local citizen's group blew the whistle. A federal geologist admits that all the aquifers in the area are contaminated in places.

Southeast of the Black Hills, on the Pine Ridge Reservation, widespread pollution has shown up. Radiation was found in the wells on the northwest part of the reservation as early as 1956, when a government study said that the radiation might mean there were uranium deposits. But the public didn't know about that until early 1980, when a study by Women of all Red Nations (WARN) publicised the contamination and exposed a variety of health problems. The reservation miscarriage rate, for example, was 6½ times higher than the national average, and certain types of birth defects and cancer were more common than they should have been.

The one thing that was known was that the radiation in one of the wells, which bordered the Cheyenne River, probably came from an old uranium mill in Edgemont. The Cheyemnne is one of the major rivers in the area and has been contaminated for some years by the wastes from the old mill, which sit on the river bank. But no-one seemed to be able to prove whether the other wells were contaminated by uranium mining -- no-one could trace the water underground.

Repeated attempts by the government to get clean water fell short as wells caved in or hit dry holes. There was talk of trucking water into the reservation, but for several years the whole thing has dragged on while people drink radioactive water.

The issues of water and energy are closely tied increasingly in the popular mind. One reason has been the plan of Energy Transportation Systems (ETSI) to use huge ammounts of South Dakotan water to move coal from Wyoming to the southern U.S. (see box) In addition, large coal-fired electrical plants in the area use billions of gallons of water each year.

Both the plants and the massive coal mining going on in eastern Wyoming and Montana pollute water with salts, radiation and heavy metals -- including arsenic and lead. These substances are trace elements in the coal and are in mine run-off and the smoke spewed into the air by the electrical plants. The coal deposits themselves are often aquifers, so the mining that takes the coal also takes the aquifers, seriously damaging an area's ability to recover after mining.

The northern Great Plains contains 42% of the nation's coal and was called "America's energy ace in the hole" by former Secretary of State Schlesinger. Early this year, what the local ranchers knew about the bad


effects of coal strip mining and its subsequent "restoration" was confirmed by a six-year study by Montana State University. This is the first study of its kind in the western states. Studying "what is probably the most progressive reclamation operation in the west," the researchers found that reclamation cannot be completed within ten years. At another plot of land, part of a widely publicised reclamation effort in the early 1970's, only two types of plants were thriving. The study concluded that the main "problem" was the weather -- not enough rain falls on the area.

The study held out hope for small areas of land mined -- after 50 or 60 years, they return to normal. But no-one knows how long the process will take for the miles of land that are now being mined -- if it ever happens. People do know that ravaged areas remain unproductive today from the western gold rushes of the 1850's and 1870's.

Uranium exploration, milling and mining all cause water problems, both from contamination and from the use of large amounts of water. Uranium milling was called "the dominant contribution" to radiation exposure from the nuclear chain by a federal study on the health effects of ionising radiation.

But radiation problems begin with exploration, which pierces thousands of holes through underground rock layers. The holes let water flow between aquifers much faster, as people discover when their wells start draining. People in the Black Hills and Wyoming have lost wells because of exploration. A well in the southern Black Hills that drained during exploration and then refilled was heavily contaminated with a variety of toxic substances. Also, cattle in South Dakota and the Southwest have died from contact with uranium drill holes.

The nuclear industry defends itself by saying that they plug holes -- or at keast they have been recently. But old drill holes, and even a few new ones in the Black Hills were found left open, or plugged with a rock, or simply camouglaged.

The hole plugging process, supposed to last indefinitely has only been proved for 25 years, and the 'proof' itself is questionable. To quiet local fears, the state of South Dakota reopened two of the sealed drill holes on the eastern flank of the Black Hills. They found that the seal under the surface of the hole wasn't there. It had either never been there, or it had been removed. The other hole contained above-normal bacteria activity. So much for quieting people's fears.

It's important to realise, though, that health is not the only thing threatened by energy activities and their effect on the water supply. People who promote energy "development tend to downplay the fact that economic gains are short term, lasting maybe thirty years. But if water becomes unusable, the long term, land based economy of an area suffers.

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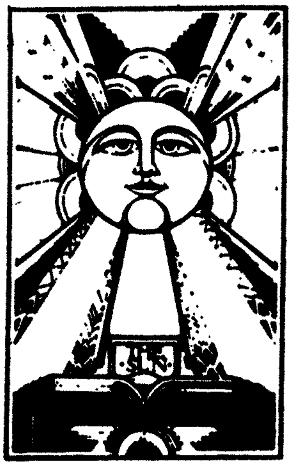

THE GHOST OF PLOGOFF REAPPEARS IN GLOMEL

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After the successful campaign against the nuclear power plant in Plogoff, new nuclear activities have to be combatted in Brittany, France.
Cogema, a semi-governmental company with 8,300 employees, manager of the reprocessing plant in La Hague, has applied for a permit to explore the area around Glomel. The area is known to be rich in uranium. The French government is keen to become self sufficient in its uranium stocks for their atomic energy and atomic weapons programme, and not dependant on foreign imports.

Nobody in Glomel was informed of the permit to explore, although articles were published in newspapers in nearby towns. People were not letting the officials continue in secret. A few days after the permit became known, a public meeting was called and the dangers of uranium mining were discussed. 700 people attended, mostly farmers. They initiated a petition for the St Brieuc local government. 1817 people signed the petition, demanding the immediate halt of all exploration.

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"An exceptional resource, both for news and for network-building. If you're involved in any branch of the safe energy movement, get to know WISE -- and let WISE get to know you." *--RAIN Magazine, USA*

"Thanks for your News Communiques and Bulletin. They are very important publications to us here. We hope they will be a strong instrument for people around the world to fight for a safer life and to spread the circle of the anti-nuclear movement." *Yoji Takemoto, PRIEE NEWS Editor, Tokyo, Japan*

"From 1979, we have been using WISE publications: *The Bulletin, Keep It In The Ground, and the News Communiques,* as the most important sources of information for international news on energy issues. WISE has helped us in our efforts by providing a lot of information which otherwise would have been quite difficult for us to obtain.... The existence of WISE is vital for this movement and for all people concerned about the energy issue." *Boletin de Information sobre Energia Nuclear (BIEN), Tarragona, Spain.*

"We send you a warming thought, having followed your work through WISE for some years now. We are a small branch of "Folkkampanjen mot Kärnkraft" (The People's Movement Against Nuclear Power) in Sweden. You will soon get some money from us to help up the economy. WISE is important and you do a wonderful job. We sincerely hope you and WISE will get on your feet again!" *Folkkampanjen mot Kärnkraft, Lidingö, Sweden.*

"I was one among the many Government scientific advisers in the 1950s who were in favour of starting the nuclear power station programme. I thought, as all my colleagues did, that this would prove to be a safe and economic source of primary energy. Events since then have shown how wrong we were. How can we stop this rush to nuclear disaster? The answer is by AN INFORMED AND POWERFUL PUBLIC OPINION. The World Information Service on Energy -- WISE -- helps to promote this. But it works on a shoestring, opposing those with a bottomless purse. Help to fund this courageous venture ... " *Sir Kevin Spencer, U.K.*

"In the past and up until today, the organisation NANAI, the Dutch Action group North American Indians, has frequently and effectively used the information made available through the WISE *Bulletins*, and particularly through *KIITG*. Without this information we would not have been able to do our work on the effects of uranium mining on Native American and Canadian land as well as we have, and as well as we will continue to do." *Rick Looijen, NANAI, Groningen, The Netherlands.*

"WISE provides the kind of information necessary for the movement, which too often is not reported in the establishment media. It is vital for people of different countries sharing the same struggle to know what is going on elsewhere. If we are to succeed, we need to work on an international level. For this reason, WISE is indispensible." *Bob Alvarez, Radiation Health Information Project, Environmental Policy Institute, Washington, DC, USA.*

"Let me congratulate all those involved in the production of the WISE *Bulletin:* it opens up the possibility of important networking among groups globally who are working towards a non-nuclear society. We are really pleased with the WISE publications and will pass along information for you." *Ontario Public Interest Research Group, Guelph, Ontario, Canada.*

"Many thanks for your support. The Swiss scene is small, and that makes for an agressive pro-nuclear lobby; we are therefore very grateful for your help." *Peter Hug, Arbeitsgemeinschaft gegen Atomexporte, Bern, Switzerland.*