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The Director of Central Intelligence
Washington, D.C. 20505

National Intelligence Council

NIC #02386-86
14 May 1986

MEMORANDUM FOR: Director of Central Intelligence
Deputy Director of Central Intelligence

FROM: [Redacted]
Acting NIO for Economics

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SUBJECT: Economic Costs of the Chernobyl Incident

1. I believe many analysts are overestimating the economic costs of the Chernobyl accident to the USSR. The attached articles (Attachments A and B) imply the costs will be high indeed. I think Moscow can contain the economic costs to well under \$10 billion, keeping them within the limits of a very significant, but hardly catastrophic, natural disaster.

2. According to the analysts in SOVA, loss of grain, livestock, and farmland will be minimal. As for other costs, it is only possible, of course, to make order of magnitude estimates at this point.

- Assuming the permanent relocation of 10,000 families in the area at \$20,000 each, the cost would be \$2 billion plus, say, \$500 million for temporary relocation of others in a wider, 30 kilometer, area. (We have reports that those relocated are already being put to work.)
- The loss of the four reactors amounts to perhaps \$4 billion in capital costs. It is possible, however, that in time reactors 1 and 2 could be returned to service, depending on the levels of radiation in the immediate area and estimates of cleanup costs relative to new construction.
- Cleanup costs, including covering radioactive earth, plus loss of farmland, livestock, etc., could total another \$1 billion or so assuming the Soviets do not apply strict Western standards to contamination of meat and dairy products.

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In addition to these capital costs, loss of the four reactors represents an annual loss of power equal to 100,000 b/d oil worth about \$550 million per year. It is impossible at this point to gauge longer term costs such as delays in the power program, increased costs to improve reactor design., etc.

3. In the attached article (Attachment C) Goldman argues that the accident is a major blow to Gorbachev's effort at economic reform. I think it is more appropriately viewed as an indication of the lack of maneuvering room Gorbachev has to meet any single major economic emergency including major crop failures--let alone back-to-back problems such as the Chernobyl accident followed by a crop failure. He cannot, I believe, afford to shut down all reactors of similar design for an extended period owing to the cost of fossil fueled replacement power. Similarly, the grid cannot accommodate such losses; the system experienced periodic brownouts even before the accident.

4. As an aside, I would like to know what the power production targets were for these four reactors, whether these targets were raised under Gorbachev, and whether our people think the rate of capacity utilization allowed time for proper maintenance.

5. SOVA has drafted an article on the economic impact of Chernobyl on the USSR; EURA is doing an article on the costs to Eastern Europe. This memorandum was reviewed by SOVA.

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Attachments:

- A. Chernobyl's Impact on Foreign Trade
- B. "USSR: Domestic Impact of the Chernobyl Accident," Draft IEEW Article
- C. "A Threat to Soviet Economic Reform," The New York Times 4 May 86
- D. "The Worst Effects Will Emerge Slowly," The New York Times. 4 May 86

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Attachment A

Chernobyl's Impact on Foreign Trade

There have been a lot of rumors but few hard facts of any direct impact on foreign trade:

- Should oil be needed as feedstock for power plants to replace the power lost from Chernobyl then foregone oil earnings are approximately \$550 million for every 100,000 b/d at \$15 per barrel.
- There have been many rumors of increased grain purchases but, again, few hard facts. Indeed, given current hc constraints and some statements about cutting back imports sharply, especially for consumer goods, the Soviets may forgo any food imports to to replace losses, particularly if there not significant.
- There may some minor hc outlays to fight the disaster such as the purchase of West German robots, or the payment to medical specialists.
- There has been some speculation in the West German press about farmers bringing a suit against the Soviet Union to recover damages--the amount mentioned was \$500 million. This may lead nowhere.
- Western bankers may use this accident as one more reason to up the price of borrowing by the Soviets. So far they had kept rates low despite the poor oil market, but this may change their minds.

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Attachment B

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Draft IEEW Article

15 May 1986

USSR: Domestic Impact of the Chernobyl' Accident

Our preliminary assessment of the impact on the Soviet economy of the 26 April nuclear accident at the Chernobyl' power plant is that long-term damage will be small. Although the cost of evacuation, permanent resettlement, and cleanup will be large--possibly on the order of billions of rubles--lasting damage to agriculture, industrial facilities, and the environment will be limited to a fairly small area. We believe Moscow can contain these costs and keep them within the range of those associated with a significant, but hardly catastrophic, natural disaster. It will be a long time before the full economic impact of the accident is realized, but we believe there are a number of preliminary assessments that can be made.

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The Evacuation

According to the Soviet press, the nearby town of Pripjat' (population 47,000) was evacuated the day after the accident occurred. An 1,100-bus convoy reportedly completed the operation in less than three hours. It was not until 4 May, however, that the town of Chernobyl' (population 44,000), 15 kilometers (km) from the damaged plant, was evacuated. The Soviets' decision may have been the result of a shift in wind direction. The evacuation was completed two days later. Host areas for the evacuees include towns and rural areas in Belorussia north of Chernobyl' and villages to the south of the plant (see figure 1).

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As of 12 May, Moscow acknowledged that 92,000 persons had been evacuated from a 30-km exclusion zone around the plant. We estimate the population of this area to be 150,000-180,000 including the two towns of Pripyat' and Chernobyl' and the surrounding rural population. It is likely that many fled on foot with their livestock before official vehicles arrived. In addition to the official evacuees, thousands of persons, mostly women and children, have left Kiev and other cities outside the 30-km area. Soviet authorities tacitly supported the exodus from Kiev by scheduling extra trains and planes to transport those wanting to leave the city. The great bulk of the 2.4 million residents of the Ukrainian capital have chosen to stay.

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It is difficult to estimate the cost of the evacuation, but assuming military units were involved, little incremental costs would accrue to the Soviets. Volunteers are housing many of the evacuees, and if existing housing is properly decontaminated, residents could begin returning in a month or so. It is likely that permanent relocation will be required for some of the population. Indeed, in some areas, the evacuees are already being put to work. The largest expense will be for decontamination and cleanup near the reactor site. The Soviets report that Chernobyl' unit 4 will be permanently encased in concrete following an injection of liquid nitrogen below the reactor itself.

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What Happened at Chernobyl'?

Our best estimate of the cause of the accident is that there was a loss of power to the Chernobyl' complex as reactor number 4 was going into a planned shutdown and a subsequent failure of emergency diesel generators to start. Without power, the cooling systems could not work, and the fuel began to overheat. The overheating of the reactor core, coupled with a possible rupture of the feed water tubes running through the reactor caused a reaction between steam, fuel, and graphite that produced hydrogen gas. The gas built up until it exploded, shattering the steam lines in the adjacent steam separator and destroying the upper portion of the reactor hall. This added air to the overheated graphite, causing a fire. At this point, at least some of the uranium fuel was melting. The destruction of the reactor hall allowed large quantities of radioactivity to escape. By this time, everyone in the immediate area, estimated at 50 to 100 workers, was probably exposed to a lethal dose of radiation. Helicopters were used to drop sand, lead beads, clay, dolomite, and boron into the burning reactor. The fire was finally extinguished on 11-12 May.

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Impact on Agriculture

Agricultural production in the Soviet Union is highly diffuse and is unlikely to be dramatically affected by one event of this kind. Damage to farming regions beyond the immediate area of the accident is likely to be minimal. The initial plume of radioactivity appears to have passed over an area covered largely by forests and swamps; not more than 15-25 percent of the crop and pasture land in the Chernobyl' region would have been seriously affected. Assuming the contamination is localized, we do not anticipate substantial, long-term effects on international commodity supplies or trade.

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Nevertheless, farming activities near the site are likely to be affected. Winter grains planted last fall and sugarbeets which are just emerging have been exposed to radioactive particles settling on leaves. Some of this radiation will be incorporated into the plants. Lightly contaminated grains may be mixed with clean grain during milling to dilute any harmful effects, but any heavily contaminated grain will have to be collected and disposed of. Sugarbeets exposed to radiation would tend to concentrate radioactivity in their roots and will likely have to be destroyed. Many crops, however, have not yet been planted or are still underground and "safe" from radiation.

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According to US experts, spring grains and vegetables can be planted in areas of light contamination because most of these crops--with the exception of sunflowers--do not absorb radiation through their roots. Danger to humans, however, could result from contaminated dust raised by machinery in fields during planting, subsequent spraying, and harvesting.

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The Soviets reportedly are applying some kind of film to the surface near the reactor to prevent radioactive dust and particles from getting into the soil and water. Thorough monitoring and decontamination of workers, equipment, and crops in the Chernobyl' area will be necessary, slowing field work. Even in those areas where contamination is light, crops could suffer losses if normal spring field operations are delayed. Workers may be kept from the fields as a safety precaution or diverted to cleanup operations. Growing seasons in the USSR are short, and harvests are frequently disrupted by early onset of winter.

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The livestock industry may be more seriously disrupted in the area because farm animals, although not adversely affected by low levels of contamination, will concentrate radiation in their tissues with prolonged intake. Some rangeland may have to be taken out of use until radiation drops to acceptable levels. Grazing animals may have to be fed in stalls, or, in the immediate vicinity of the reactor, butchered. Indeed, we have already seen reports of livestock destruction because of high radiation levels. Livestock that have ingested contaminated feed should survive if quickly switched to clean feed. Radioactivity not excreted by these animals would be localized in organs generally not consumed by humans, such as the thyroid, and bones. Soviet data show, however, that the Chernobyl' region accounts for a miniscule share of total farm output in the Ukraine (see figure 2).

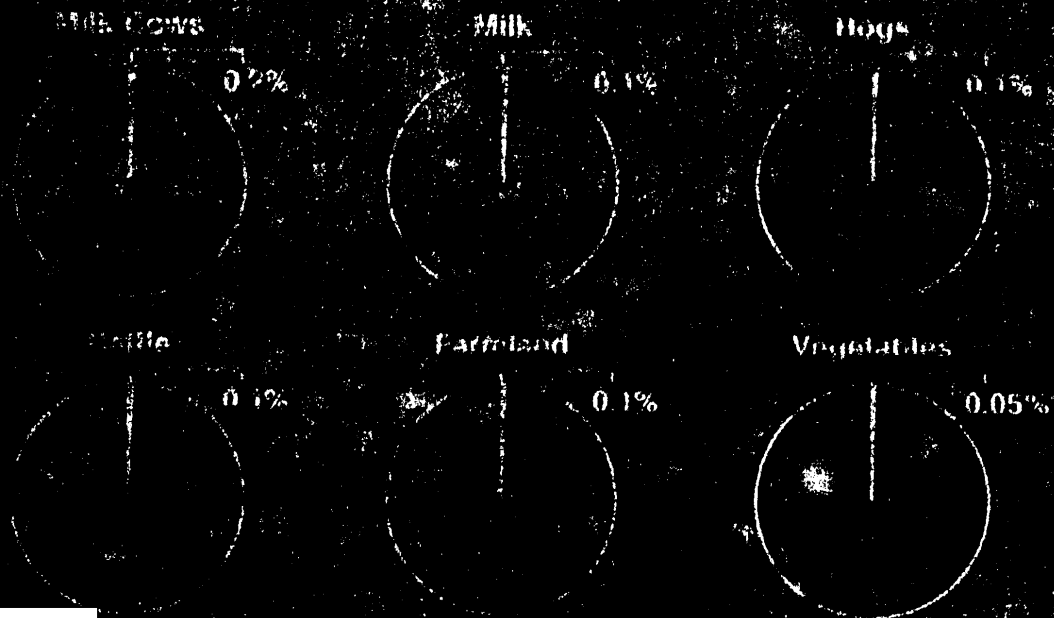
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The local dairy industry will be most seriously affected because of the impact of fallout on cows and milk where radioactive iodine concentrates. Cattle fed contaminated feed will produce hazardous milk for up to two months after switching to clean feed. Soviet dairy

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Chernobyl Region as a Share of the Ukrainian Republic



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authorities will have to monitor condemned milk disposal carefully to insure that none reaches black market channels.

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The Chernobyl' power plant is located just north of the Kiev Reservoir that supplies the bulk of the drinking water for Ukraine's capital. Some radiation was undoubtedly carried to the reservoir by winds and by the two major rivers feeding it--the Pripyat' and the Dnepr. Because these rivers drain directly through the most heavily contaminated area, radiation levels in the water will rise over the next several weeks. Radioactivity will concentrate in aquatic plants and fish--perhaps making the latter unfit for human consumption. Eventually, contamination could be carried to other reservoirs further down the Dnepr. The Soviets have constructed dikes along the Pripyat' near the reactor to prevent rain from carrying surface contaminants into the river. Soviet environmental authorities, however, maintain that regular water samples are being taken from the Kiev Reservoir and that they show levels below established norms.

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Local Industry

An inventory of industrial facilities within the 30-km zone around the reactor reveals only a small number of civilian plants, including perhaps ten food-processing sites, three textile mills, a railroad repair yard, and a small thermal power plant. The evacuation is likely to have disrupted production at several of these facilities. How long they will be affected remains an open question, depending on the degree of contamination and the extent the Soviets want to preserve their operation. Moscow has already discussed bringing the undamaged reactors at Chernobyl' back on line as quickly as possible, so presumably the Soviets would also

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attempt to help local industry recover as well. [REDACTED]

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In all likelihood, the accident disrupted--at least temporarily--electricity supplies beyond the 30-km area. All industries suffer problems in the event of brownouts or blackouts, but the largest users of energy--metals processing, cement, food processing, and chemicals--would be hardest hit from resulting damage to machinery and products in process. We have no information to date regarding specific disruptions in electric power supplies to local industry. [REDACTED]

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Like electricity, all industrial facilities depend on water for cooling and processing. If the Soviets have or chose to cut off water supplies in the area, the industries most vulnerable to production cutbacks would be chemicals and metallurgy, as well as companion thermal power plants. Switching to closed water systems, however, could ease potential shortages for plants in appropriate locations. The use of irradiated water in processing has the potential to alter end products, particularly in the chemical and food sectors. We have received no reporting of disruptions in industrial water supplies in the area. [REDACTED]

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Electricity Supplies

The shutdown of the four, 1000-megawatt (MW) reactors at Chernobyl' will probably have a wider range of effects, both direct and indirect. During the summer lull in electricity demand, the Soviets will be in a favorable position to compensate for most of the power losses associated with Chernobyl' by using other generating capacity more intensively. Beginning in August, however, the upsurge in demand probably will eliminate most of the painless adjustment mechanisms. [REDACTED]

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[REDACTED] four additional reactors identical to the damaged one at Chernobyl'--two at Kursk and possibly two at Smolensk--may not now be operational. We cannot be certain whether these other reactors are completely shut down or are operating at reduced power levels for safety reasons. Indeed, we cannot be certain whether all these reactors--if they are in fact shut down--were all taken off line in response to the Chernobyl' accident. Moscow would need strong justification to disrupt the economy further by shutting down the remaining seven graphite-moderated, boiling water reactors (RBMK) similar to those at Chernobyl' unless the cause of accident is judged to have stemmed from basic design faults. [REDACTED]

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The total effect of the confirmed shutdowns at Chernobyl' and the likely shutdowns at Kursk and Smolensk--assuming the latter reactors remain out of service for the remainder of the year--will be to reduce Soviet power output in 1986 by about 50 billion kilowatt-hours (kWh), or 3-4 percent of the annual total. The impact, however, is concentrated on two power grids, the Center Unified Electricity Grid (OES) and the South OES, which will experience much greater losses of about 15 percent and 10 percent, respectively. Power cuts of this magnitude could seriously affect key economic activity in the Ukraine and Moscow regions. We believe the Soviets will attempt to ease the impact by drawing electricity from adjoining grids in the Northwest, Northern Caucasus, and possibly from more distant grids in the Urals and Kazakhstan. Moscow may also request that Czechoslovakia, Bulgaria, Romania, and Poland reduce imports of electricity from the Ukraine; roughly 20 billion kWh was sent to these countries in 1985. Cutting exports to Eastern Europe, however, may not be a politically attractive way to ease the crunch. [REDACTED]

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The Soviets could compensate for the loss of electricity over the next several months if they forego maintenance--normally scheduled for the summer--at power plants using fossil fuels (oil, natural gas, coal, and peat) and operate them at full winter capacities. Increasing output at conventional plants, however, would only be a stopgap measure. Maintenance must still be performed, and if it is not finished by winter, the Soviets will be even harder pressed to meet the surge in demand that will take place then. In any event, domestic supplies of fossil fuels will have to be supplemented with sizable increases in domestic fuel production and possibly with imports, such as additional coal from Poland. As the Soviets move to replace electricity from the affected RBMK reactors with power from conventional plants, they will need to use plants connected to the right grids as well as additional fuel of perhaps 150,000 barrels per day oil equivalent to replace the Chernobyl' reactors or twice that much if the other four reactors are shut down.

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The long-term impact of the Chernobyl' disaster on the USSR's ambitious nuclear power program is likely to be significant. The Soviets currently have 28,300 MW of nuclear generating capacity, supplying some 11 percent of their electricity. Moscow's plans call for expansion of nuclear capacity to 70,000 MW by 1990, boosting the nuclear share of total electricity output to more than 20 percent. The accident will prompt the Soviets to at least put construction of new RBMK reactors on hold temporarily. The Soviet decision to allow placement of nuclear plants closer to populated areas to supply centralized district heating systems is likely to reexamined.

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Political Fallout

The accident is likely to have significant political repercussions inside the USSR. At the least, it will break Gorbachev's momentum and disrupt his efforts to inspire optimism among the public. The regime badly bungled public relations in the first days--reacting in traditional Soviet fashion of trying to conceal from its own population and the world the fact that there was an accident. An incorrect assessment of the seriousness of the incident by local officials may have caused some delay. But once it became clear that the West could independently assess the disaster, that Soviet citizens were hearing about it from foreign sources, and that a large-scale evacuation would be required, Moscow shifted its approach.

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In an effort to absolve the top leadership of responsibility, Soviet authorities are blaming low-level local officials for mishandling the situation. Boris Shcherbina, Deputy Premier and head of the internal investigating commission set up by Moscow, said that local experts did not make a "true assessment of the accident" quickly enough. Pravda reported on 12 May that two transport officials at the plant and a plant party secretary had been punished for failing to meet the needs of the evacuees and for providing delayed and inaccurate information on the accident.

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Ukrainian party leader Vladimir Shcherbitskiy could eventually be held responsible. Gorbachev has been widely suspected of wanting him out, and a public statement by Ukrainian premier Lyashko was defensive about the initial handling of the disaster, suggesting republic officials were under criticism from Moscow. Scapegoats may also be sought within

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the central party and government apparatus. Vladimir Dolgikh, the party secretary in charge of the energy sector is one of only two Brezhnev holdovers in the Secretariat. His failure to be named to head the investigating commission could spell trouble for him. In the government, Minister of Power and Electrification Mayorets is the official most directly responsible for the power plant. He was criticized for inefficient management at the party congress earlier this year.

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General Secretary Gorbachev himself remained in the background in dealing with the Chernobyl' incident, allowing other Soviet leaders to assume high profile roles during the crisis, until 14 May. He may have believed that his visible public involvement would have increased public alarm. He also may have waited to speak until it was clear that the situation was well under control in order to avoid giving reassurances that would eventually turn out to be unduly optimistic. (insert stuff from Gorbachev's speech, if any).

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THE GRIM TOLL OF CHERNOBYL

Attachment C

A Threat to Soviet Economic Reform

By MARSHALL I. GOLDMAN

WHILE there obviously is never a good time for a nuclear meltdown, the Chernobyl disaster comes at a particularly awkward moment for the Soviet economy. It may well abort Mikhail S. Gorbachev's ambitious effort to turn the Soviet economy around.

Before Chernobyl, Mr. Gorbachev's efforts to discipline and motivate the Soviet work force were beginning to bear fruit. According to official Soviet data, in the first three months of 1986, industrial production rose 6.7 percent and labor productivity 6.3 percent over the comparable period in 1985.

Even oil production was increasing again. Since Mr. Gorbachev made a personal tour of the west Siberian oilfields last year, fired several officials and criticized many more, production — which at one point was down by 4 percent on a monthly basis — has rebounded to a 2 percent growth rate, compared with the same month a year before. Equally impressive, steel production increased by 10 percent in the first quarter of 1986, compared with a year earlier, something not seen for a decade or more.

Building on this momentum, Mr. Gorbachev seemed to be preparing to bring high technology and better services to the Soviet Union so that it would be competitive with the United States not only in military strength but in economic sophistication. Given the resistance to previous attempts at reform, this may have been an unattainable dream. But to make any inroads, Mr. Gorbachev realized he would have to establish his credibility as a manager and leader, and he seemed to be doing just that — until Chernobyl.

The accident jeopardizes not only his credibility, but also the economic momentum he has generated. There is no way that Mr. Gorbachev could have escaped at least some criticism for Chernobyl, but the inept, if not unconscionable, way the Soviet people have been kept in the dark about the potential dangers has turned a bad situation into one with unusually serious and enduring consequences.

The first economic casualty, then, is the sense that the Soviet Union had finally found itself a leader who would provide his people with the openness and respect they have so long been denied. As the editors of *Sovietskaya Rossiya*, a Moscow newspaper, said in January, "In the interests of truth and of speaking openly with people on all vital questions, our information must be up-to-date, accurate and complete." For Mr. Gorbachev, Chernobyl fails on all three accounts.

The second casualty is the Soviet energy industry. At a minimum, Chernobyl's four generating units, with a total capacity of 4,000 megawatts, will be out of commission for the foreseeable future. Even though the units account for almost one-half of the Ukraine's electrical capacity, nuclear-generation provides only 11 percent of the Soviet Union's total electric energy. So the loss of Chernobyl is not irreplaceable, particularly now that the weather is warmer and the days sunnier. Yet, in a country long accustomed to brownouts, any loss of capacity hurts.

Moreover, the accident will slow the Soviet's nuclear drive, requiring the diversion for electricity generation of more natural gas, coal and possibly some petroleum that otherwise could be set aside for hard-currency exports. Fortunately for Mr. Gorbachev, oil production is increasing again, but that increase will not compensate for the fall in world oil prices, all the more so if more energy must be kept for home consumption.

The last thing the Soviets need is a further crimp in their hard-currency earning abilities — Soviet foreign debt will increase by over \$5 billion this year because of falling oil prices. The recent shift in the winds to the south and the east from Chernobyl is putting many important Soviet crops in the country's rich black-soil zone at risk. Assuming Soviet leaders do the right thing (which at this point is not all that certain), they will destroy some of these crops, which will necessitate increased imports. For a nation that imported \$7 billion of grain in 1984, any further loss is unwelcome, though by no means devastating.

None of these setbacks is insurmountable. The more important consequence of Chernobyl may be the dashing of Mr. Gorbachev's hopes for reforms, innovation and inspired leadership. ■

THE NEW YORK TIMES, SUNDAY, MAY 4, 1986

Attachment D

The Worst Effects Will Emerge Slowly

By HERBERT L. ABRAMS

THE history of the 20th century is a confirmation of the wisdom that the impossible is always possible. Whether in the destruction of Challenger or in the meltdown at Chernobyl, the seeds of disaster were planted long before the event, and the repercussions will be felt long after.

What are the likely environmental and health effects of Chernobyl? For a few in the immediate vicinity who were heavily exposed to radiation, it could mean death within days, weeks or months, depending on the extent of exposure. For many others, who were

Herbert L. Abrams is professor of radiology and a member-in-residence of the Center for International Security and Arms Control, at Stanford University.

exposed to less severe — but still critical — amounts of radiation, it could mean a bone-marrow death that could occur in weeks to months. Fluid replacement, antibiotics and stringent sterile precautions may save many in this group.

At least 14 different isotopes drifted into Scandinavia, including the hazardous radioactive iodine and cesium. As the wind's direction changed, countries adjacent to the Ukraine — Poland, Rumania, Bulgaria, Yugoslavia and Austria — experienced increased levels of radioactivity.

Radioactive iodine is deposited on the soil and in plants, ingested by cows and it appears quickly in milk. Once ingested, it accumulates in the thyroid gland and may destroy thyroid tissue and ultimately produce thyroid nodules and even cancer. Cesium is threatening because it continues to produce radiation for decades after it has been taken up by human tissues.

What of the area around Chernobyl? Land within 5 to 15 miles of the reactor may be contaminated for many years and could be uninhabitable. Over days, weeks and months, as fallout settles to the ground, water, lakes, rivers and crops may be contaminated at distances beyond the immediate area.

A major concern of the Chernobyl accident is not only the reservoir that supplies Kiev — which must have increased radioactivity — but the Dnieper River that flows out of the reservoir and south to the Black Sea. Both immediately, and for weeks and months thereafter, the use of impure water must be sharply restricted, and contaminated agricultural products impounded.

The expense of Three Mile Island — huge though it was — may pale beside the Chernobyl disaster. Any estimate must include the cost of evacuating and relocating thousands of people; of medical care for hundreds with radiation sickness and possibly burns; of workdays lost; of a sustained interruption of one-seventh of all Soviet nuclear power for the Ukraine and Eastern Europe; the decontamination of a large area that may remain "hot" — excessively radioactive — for months or years; agricultural products that must be junked, and property that cannot be used. The pressure will be great to close or redesign those reactors without appropriate containment, and the cost attached to all new Soviet reactors will rise sharply.

The human tragedy of the dead, injured and evacuated is clearly the central concern of the world community. But the secondary effects of Chernobyl are inestimable, and none are more aware of this than those in the nuclear power industry in this country and in other lands. ■

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SUBJECT: Economic Costs of the Chernobyl Incident

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