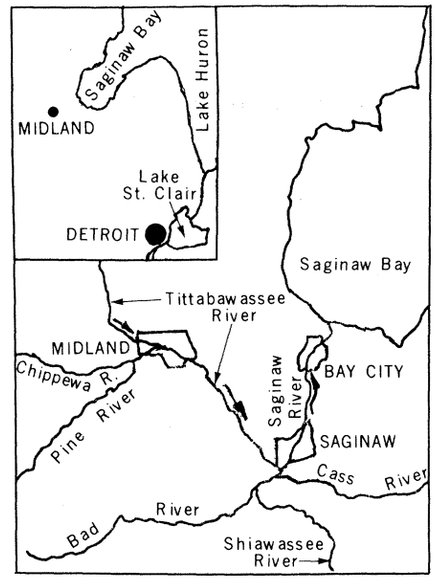
that "We learned so much about dioxins in order to defend our pesticides."

Dow learned of the combustion-dioxin connection in a roundabout manner. First, it confirmed the presence of dioxins in the Tittabawassee by placing fish in cages submerged at points upstream and downstream from the point of discharge from its plant. Dow determined, and the Midwest office of the EPA later confirmed, that dioxins were present at low levels in the fish downstream from the discharge and, except for the presence of octa in one fish, in none of those from a point upstream from the discharge. Next, in an attempt to locate the source of the contamination, Dow sampled soil on the plant grounds and found concentrations of the dioxins ranging from 0.3 part per billion to 20.5 parts per million (a maximum of 0.1 ppm for TCDD, the most toxic). Dioxins were also found in dust samples from a Dow research building, and, in order to obtain control samples, Dow also tested the dust from several metropolitan areas. After finding that dioxins were present in the urban dust, it was but a short step to discovering them in auto mufflers, fireplace ash, cigarette smoke, and charcoal grills.

Although Dow officials believe their study points the finger at other sources



Map by Eleanor Warner

of TCDD river contamination, EPA officials note that the highest levels of dioxin were found by Dow to be in and around the Dow plant. "Dow's own incinerators could even be the cause," says Lyman Condie, an EPA toxicologist in Chicago. In the study, Dow expresses reservations about the reliability of data showing contamination of the plant's own sewage water, noting that the amounts uncovered are near the limits of detection; similar reservations were not expressed about data collected outside the plant that are also near detection limits. And Dow admits, "We cannot demonstrate that some of these chlorinated dioxins did not come from manufacturing plants."

Why, if the report does not provide a definitive explanation for the contamination of the Tittabawassee, did Dow so earnestly pursue the dioxin search and so loudly proclaim that a component of its pesticides may be present naturally throughout the environment? After all, the EPA, which is currently requiring Dow to prove the safety of 2,4,5-T or remove it from the market, could reason that the danger to humans from the deliberate addition of dioxins to the environment is more severe because dioxins are present there already. The answer to the question is apparently in the assertion of Kagel that "our research proves that dioxins are present not just in Michigan. . . . Because dioxins are ubiquitous, we need not be concerned about them." The EPA, however, is not likely to accept such a view. As Condie says, "The report has not changed our basic position on dioxin-contaminated pesticides, which is that they pose a threat to human health."—R. JEFFREY SMITH

Anti-Semitism Alleged in Soviet Mathematics

Last summer, mathematicians gathered in Helsinki at the International Congress of Mathematicians to award Fields Medals—the equivalent in mathematics of Nobel Prizes—to their finest young researchers. Four Fields Medals were awarded, but only three of the winners were present to accept their awards. The fourth winner, Gregory Margoulis of the Soviet Union, was not permitted to attend the Congress. When Margoulis applied for a visa, he was told his work was not good enough to represent the Soviet Union. Naturally, this incident caused quite a furor. Writing in the Research News section of *Science* (20 October), George Mostow of Yale University said of Margoulis' absence, "In homage to [Margoulis'] achievements, the entire audience . . . rose to its feet, in a spontaneous gesture of admiration for the medalist who was so conspicuously absent."

Margoulis is Jewish. That is the reason, sources say, that he was refused permission to go to Helsinki. The Margoulis incident is only the latest of a series of alleged instances of anti-Semitism in the Russian mathematical community. Jewish students are prevented from entering universities, even when they display impressive mathematical talent. Jewish mathematicians are prevented from receiving advanced degrees, from publishing, and from attending international meetings.

Recently a group of Soviet émigrés wrote a white paper describing the situation in Soviet mathematics. The paper was widely circulated among mathematicians in the United States and at last summer's International Congress in Helsinki. A number of copies of the paper are also circulating in the Soviet Union. An edited, some say whitewashed, version of this paper was just published in the November issue of the *Notices of the American Mathematics Society*. Although the émigrés did not sign the paper, it was signed by 16 leaders of the U.S. mathematical community, who vouched for the trustworthiness of the authors.

Science obtained details of the repression of Soviet Jewish mathematicians from the original version of this white paper as well as from conversations with informed sources (who wish to remain anonymous because they fear reprisals against their Soviet contacts) and from a paper written by Soviet Jewish mathematician Grigori Freiman. Freiman is professor of mathematics at the University of Kalinin, and his paper was published in the underground samizdat journal in Moscow.

American scientists with close Soviet contacts say the situation in the Russian mathematics community is worse than in

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other scientific disciplines. For example, they say that a Jewish physicist can be elected a Corresponding Member of the Soviet Academy of Sciences, but a Jewish mathematician cannot. In addition, Jewish physicists can sometimes attend international meetings, but Jewish mathematicians cannot. One Soviet mathematical physicist, who is Jewish, is able to attend international meetings in his capacity as a physicist, when approval is given by the physics community, but not in his capacity as a mathematician.

This blatant discrimination against Jewish mathematicians is said to be the policy of a small group of mathematicians and is promulgated in particular by Lev Semenovich Pontryagin. Pontryagin represents the Soviet Union in the International Mathematical Union, he leads the editorial board that makes the final decision on every book in mathematics proposed for publication, and he is editor of the prestigious journal *Matematicheski Sbornik*. Finally, he controls a voting bloc on the National Committee of Soviet Mathematicians and thereby determines the international contacts of Russian mathematicians.

Yet, informed sources say, some of Pontryagin's actions have been so excessive as to bring him into disfavor with Soviet authorities and his position is believed to be threatened. One mathematician explains, "Pontryagin has lost touch with the subtle art of anti-Semitism as practiced in the Soviet Union."

It is alleged that the reason Soviet authorities are embarrassed by Pontryagin is that they worry about reactions from Western scientists. Although they are not overly concerned with the opinions of Western mathematicians, they do worry that protests over discrimination against Jewish mathematicians will spread from the mathematics community to other disciplines. The Soviets are said to be particularly concerned that Western geneticists, computer scientists, physicists, and information theorists will protest. Equally feared by the Soviets are political actions, such as the recent Jackson amendment barring sales of computers to the Soviets.

Two independent sources say that Soviet authorities were embarrassed by Pontryagin's denial of a visa to Mar-

A Program to Aid Soviet Jewish Mathematicians

Concerned scientists have for some time debated the best means of aiding their Russian colleagues who are discriminated against because of religious origins or political beliefs. Some say it helps these Russians when Westerners protest their treatment, whereas others say it only harms them. Recently, the Committee of Concerned Scientists sent out to its members a six-point program devised by Russian mathematicians to help end the discrimination against Jewish mathematicians. The program is interesting not only because it provides concrete suggestions but also because it reveals much about how Russians react to actions by Westerners.

- The Russians ask that Americans publish a list of people who, rather than just bending with the wind, go out of their way to carry out anti-Semitic practices. They suggest that these people be blacklisted from the programs of international conferences and that it be made known that they are being blacklisted. (Such a blacklist would put pressure on the promulgators of anti-Semitism because Russians who go abroad can purchase much sought after consumer items and gain political status from their travels.)
- The Russians ask that when Americans invite Russians to this country, they insist on getting the invited people. If any of the invited Russians are not permitted to come to the United States, the invitations to the Soviets should be rescinded. (This scheme has already been successfully employed by scientists in other disciplines.) Conversely, if some members of a group of American mathematicians who expect to journey to the Soviet Union are unexpectedly not given visas, the entire group should refuse to make the journey.
- Some Russians who cannot publish their papers in the Soviet Union do manage to have their papers smuggled out of the country. Typically, such a paper will be submitted to a U.S. journal, sent to a referee, and then returned to the Russian author for revisions. The Russian author, however, never sees his paper because it is intercepted at the Soviet border. Moreover, the author is liable for smuggling a classified document. (The Soviets consider all scientific papers classified until they are accepted for publication.) To avoid this difficulty, it is suggested that American mathematical journals appoint a Russian editor to their boards. This Russian editor could accept submitted Russian papers for publication and then, legally, send them to the United States.
- When Americans publish translations of Soviet books and articles, they typically hire translators who speak Russian well but who are unfamiliar with the mathematics in the book or paper to be translated. In many cases, the resulting translation is so poor that even specialists in the particular mathematical field cannot understand the book or article. There are even cases in which Russians proved famous theorems but their results were unknown because the translations were poor. To ameliorate this situation, it is suggested that Americans hire the authors themselves to translate their books and articles. (Almost all Russian mathematicians know English well enough to do this.) If the Russians refuse to allow the author of an article to translate it, the Americans should withdraw their offer to have it translated. When the authors of articles are hired as translators, the authors gain political power. (Apparently, the Soviets always want to know which Russians are respected by Westerners so they can ask those Russians to appeal to the West on the Soviet Union's behalf.)
- All protests dealing with the situation in Soviet mathematics should involve scientists from several disciplines, particularly physics, computer science, and genetics. It is also suggested that world-famous scientists sign protest letters. The Russians say a protest letter signed only by mathematicians carries minimal weight.
- The Russians hold to an exponential decay theory of scandal: it hits with a big force and then it dies down. They feel that if they can weather the initial brunt of a protest, they can safely ignore the problem. Therefore, it is suggested the Americans make all protests cumulative and periodic. For example, the denial of a visa to Margoulis (see main story) should be mentioned with every protest and the protests should be made at regular intervals. Such a style of protesting causes the costs to the Russians to mount.

—G.B.K.

goulis, whose absence at the International Congress highlighted Pontryagin's policies. Matters were made worse, the sources say, when Pontryagin, as leader of the Soviet delegation to the International Congress, was called to account for Margoulis' absence. Pontryagin angrily said that Margoulis could not be nominated for a Fields Medal because he was not a Russian nominee. He then said every country should nominate its own Fields Medal candidates, and that if this procedure is not followed in the future, Russia will not attend International Congresses.

Pontryagin was bluffing when he made this threat because he does not have the authority to pull Russia out of future International Congresses. The sources say he then got himself in deeper trouble by writing to every Soviet satellite, telling them they must support him in his threat. Pontryagin's letters were forwarded from the satellites to Moscow, whereupon Pontryagin was alleged to have been called in by authorities and told he should not make political decisions.

The two independent sources say that Pontryagin's actions at the International Congress are only one of several examples of his moves that have gotten him into trouble with Soviet authorities. For example, they say that Soviet authorities were also embarrassed when Pontryagin invited a writer, Ivan Shetsov, who was removed from the staff of *Pravda* because of his open anti-Semitism, to speak at the prestigious Steklov Institute. Shetsov gave a virulently anti-Semitic speech, following which his audience sat silent, stunned at his immoderation. Then Pontryagin is alleged to have arisen and said that he agreed with the writer's views.

The situation in Soviet mathematics, under the influence of Pontryagin and a few others, has taken on the air of a tale by Kafka. No one publicly admits to anti-Semitism, but it is known to all Russians as the reason why Jews are kept out of the mathematics community. Freiman, for example, writes that a naïve foreigner may miss the subtle discrimination against Jews because the foreigner is "like a blind person in a strange room." He goes on to explain, "People are not accepted in universities because they do not pass the entrance exams. They are refused jobs because there are no vacancies. A dissertation is rejected because of poor quality. You would be derided if you alleged that the candidate's nationality played any role in these decisions. Not a single court would undertake the investigation of a case concerned with the oppression of national minorities because such a thing does not exist."

Year	1970	1971	1972	1973	1974	1975	1976	1977
Volume	81 82 83	84 85 86	87 88 89	90 91 92	93 94 95	96 97 98	99 100 101	102 103 104
Total number of articles	31 38 36	31 37 33	36 37 36	36 32 38	37 43 31	33 29 34	34 37 30	34 32 29
Number by articles of Jewish authors	11 20 12	17 15 16	14 10 9	11 11 12	11 12 10	7 2 3	3 2 3	4 1 0

In 1975, Pontryagin became editor of Matematicheski Sbornik. *Since then, the number of published papers by Jewish authors has declined to zero.*

Although it is officially denied, discrimination against Jewish mathematicians is nonetheless effective according to the Soviet émigrés, who report that since 1975 the number of published papers by Jewish authors in *Matematicheski Sbornik* has declined to zero. It was in 1975 that Pontryagin became head of the editorial board of that journal and appointed his supporters to the board. Particularly offensive to the Jewish mathematicians, sources say, is the habit of Pontryagin and his supporters of referring privately to this and several other journals as "judenfrei"—the German expression for "free of Jews."

Another example of anti-Semitism in the mathematical community is the rejection of dissertations submitted by Jewish mathematicians seeking doctoral degrees. (The Soviet doctoral degree is a much higher degree than the Ph.D., the Soviet equivalent of which is the Candidate of Science degree.) Doctoral dissertations are first approved by the faculty of science at the candidate's university. Then they must be approved by the expert committees of VAK (the Central Attestation Committee). It is alleged by Freiman and by the émigrés that specially selected readers—popularly known as "puppet readers"—are chosen by VAK to write deliberately false reports rejecting the dissertations of Jews. This has been so effective, the émigrés say in their white paper, that many world-renowned mathematicians have no doctoral degrees.

The émigrés report that although discrimination began with the rejection of doctoral dissertations, it has recently spread to the rejection of Candidate of Science dissertations as well. This was accomplished when VAK ensured that the degree-awarding councils at these institutions were constituted of "individuals known more for their political than scientific activity," the émigrés charge.

Still other evidence of anti-Semitism is the dearth of Jewish students admitted to universities. For example, since 1970, only two to four Jews have been admitted each year to Moscow University. In contrast, in 1964, 84 out of 410 students graduating from Moscow University were Jewish. Among those rejected are winners of mathematics olympiads—competitions especially designed to pick out students with extraordinary mathematical talent. According to the émigrés, the few Jews who are admitted to Moscow University are mostly friends or relatives of influential people.

The émigrés and Freiman say that Jews are kept out of universities by specially selected examiners who give Jews unusually difficult oral entrance examinations in mathematics or physics. These examinations require specialized knowledge that goes far beyond what is taught in high school programs. If a Jewish student nonetheless does well on such an examination, he is given a test in written composition and failed for an "insufficiently developed theme."

The contrast between oral examinations of Jews and non-Jews is striking. Freiman tells that a typical problem given to non-Jews was: "Prove that the number $\log_2 3$ is irrational." A typical problem given to several Jewish students was: "Which is greater, $\sin 8/7$ or $8\pi/7$?" Amazingly enough, Freiman says, one young Jewish student, Yura Sorkin, actually solved this difficult problem. (Freiman admits to being baffled by how Sorkin could solve the problem without using tables.) Nonetheless, Sorkin, who had already won first prize in the All Union Mathematics Olympiad and whose father is a faculty member and mathematician at Moscow University, was refused admission to that university on the basis of his oral examination.

Despite these and many other examples of anti-Semitism, sources say that most Jewish mathematicians in the Soviet Union do not want to emigrate. (Even those who do wish to emigrate give as their primary reason the fact that their children are being denied an education.) In lieu of leaving Russia altogether, the Jewish mathematicians wish to pressure the Russian government to crack down on the small group of mathematicians who are implementing the anti-

Semitic policies. They are particularly anxious to hasten the fall of Pontryagin because the two mathematicians vying to succeed him, Nicolai N. Bogolyubov and Juri V. Procharov, are not considered anti-Semitic. It was in order to bring about such pressure that the émigrés wrote their white paper.

Of course, Russian anti-Semitism is nothing new. It dates back to the days before the Russian revolution and in fact was taught by the old Russian church Prava Slava. But anti-Semitism did not greatly affect the Soviet mathematical community until World War II. Anti-Semitism peaked in the last years of Stalin's life and then diminished somewhat under Khrushchev. Then, in the 1960's, anti-Semitism in mathematics began to increase again as a small group of mathematicians gained positions of power. The émigrés explain that the activities of this small group "permitted the spread of anti-Semitism into areas where purely bureaucratic control is insufficient and where the implementation of such policies requires an act of collusion by qualified mathematicians."

Such charges of anti-Semitism are often countered by observers who note that the Jews are a suspect community in the Soviet Union. Since so many have emigrated, those remaining behind are said to share guilt by association, an image of a group of people whose allegiance is elsewhere. Thus a number of Russians are in favor of denying Jews entrance into universities not because they are Jews per se but because they may eventually leave Russia. (In the Soviet Union, education is viewed as a state investment in individuals.) However, the discrimination against Jewish mathematicians predates the large-scale Jewish emigration from Russia which a number of observers feel is being used to rationalize anti-Semitism.

One of the most tragic aspects of the discrimination against Soviet Jewish mathematicians is its effect on Russian mathematics. Many scientists contend that there is no field of knowledge or culture to which Russians have contributed as much as mathematics. But the incredible respect paid to Russian mathematics is dissipating as it becomes apparent that Russians can rise in the mathematical community not because of their talent but because of their political beliefs.

As a promulgator of these discriminatory policies, Pontryagin himself is a tragic figure, one mathematician says. He was a truly great mathematician, and it is always tragic when a great mathematician becomes known not for his work but for his bigotry.—GINA BARI KOLATA

Briefing

Utility Industry Is Cool to Voltage Reduction Project

Some of the more expansive advocates of energy conservation hold that conservation opportunities can be found almost everywhere and that some are very easy pickings indeed. The California Public Utilities Commission (PUC) believes that it is making the most of one such opportunity through its program of conservation voltage reduction (CVR).

But utilities outside of California and the utility commissions of other states have been slow to embrace CVR. In fact, the utility industry tends to throw cold water on voltage reduction as a conservation measure.

The California CVR program, now nearing the end of its second year, is expected to achieve savings in 1978 of more than 2.8 billion kilowatt-hours of electricity, or the equivalent of 4 million barrels of low-sulfur oil worth about $60 million. By 1985, the savings are expected to total more than 3.5 billion kilowatt-hours, equivalent to 5.3 million barrels of oil.

Moreover, according to the commission, CVR is being applied in a selective fashion which requires no capital investments that are not cost-effective. Also, properly applied, it does not degrade the quality of electric service, unlike the system-wide voltage reductions or "brown outs" sometimes resorted to by utilities in power emergencies. In fact, a PUC report issued last January said the program "has been highly successful both in conserving energy and allowing longer, cooler, and more dependable motor, lamp, and appliance service."

California utilities seem by and large to be embracing the program in good spirit even though it means a reduction in their potential electricity sales and revenues. In a letter to the head of the PUC early this year, Jack R. Horton, board chairman of the Southern California Edison Company, said that the system-wide savings from voltage reduction appeared to be twice what had been expected and that the company was in the process of "further increasing this significant energy savings [program]." For a general rule of thumb, PUC engineer George A. Amaroli says that there is a 1 percent energy saving for every 1 percent of voltage reduction.

What the CVR program involves is lowering the top of the voltage range in which lights, motors, and appliances operate efficiently. For many years, the utility industry has voluntarily observed as its standard the range of 114 to 126 volts prescribed by the American National Standard Institute, Inc. Under the CVR program, substation voltage regulators are recalibrated to reduce the maximum to 120 volts, at least for those distribution feeder lines where this can be done economically and without lowering the voltage for customers at the end of the line below 114.

In light of all the talk over the past 5 years about energy conservation, why has the CVR concept not been widely adopted? The fact is, many utility engineers believe that CVR is not cost-effective and does not actually produce a conservation effect as great as the one claimed by the PUC (a study made in 1974 by the American Electric Power Service Corporation showed relatively small energy savings). The utility industry trade group, the Edison Electric Institute, itself seems to dismiss CVR as having little promise. Some state utility commissions have indicated an interest in the California CVR project, but at least one such body, the Public Utility Commission of Pennsylvania, has rejected CVR as a conservation measure, doing so partly on the advice of the seven utilities which it regulates. "They [the California PUC] have not demonstrated any appreciable energy savings," says Richard E. Fuhrman, a supervisor of energy planning with the Pennsylvania agency. "Amaroli has an axe to grind. He is already on record as saying [CVR] is a good thing, and he is trying to back it up," Fuhrman adds.

The apparent acceptance of CVR by large, representative utilities in California and its apparent rejection by most of the rest of the industry is mystifying. But, for his part, the PUC hearing examiner who a few years ago brought the CVR concept to the fore during a rate case has an explanation for the common industry attitude. This official, Carol T. Coffey, observed in an opinion: "The sales pitch that raising voltages will increase revenues which can be used to purchase voltage regulation equipment has been made by electric industry manufacturers for many years, so that utility personnel are now well indoctrinated." Coffey cited in support of this assessment a General Electric Company data book which says, "When the average voltage on a feeder

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