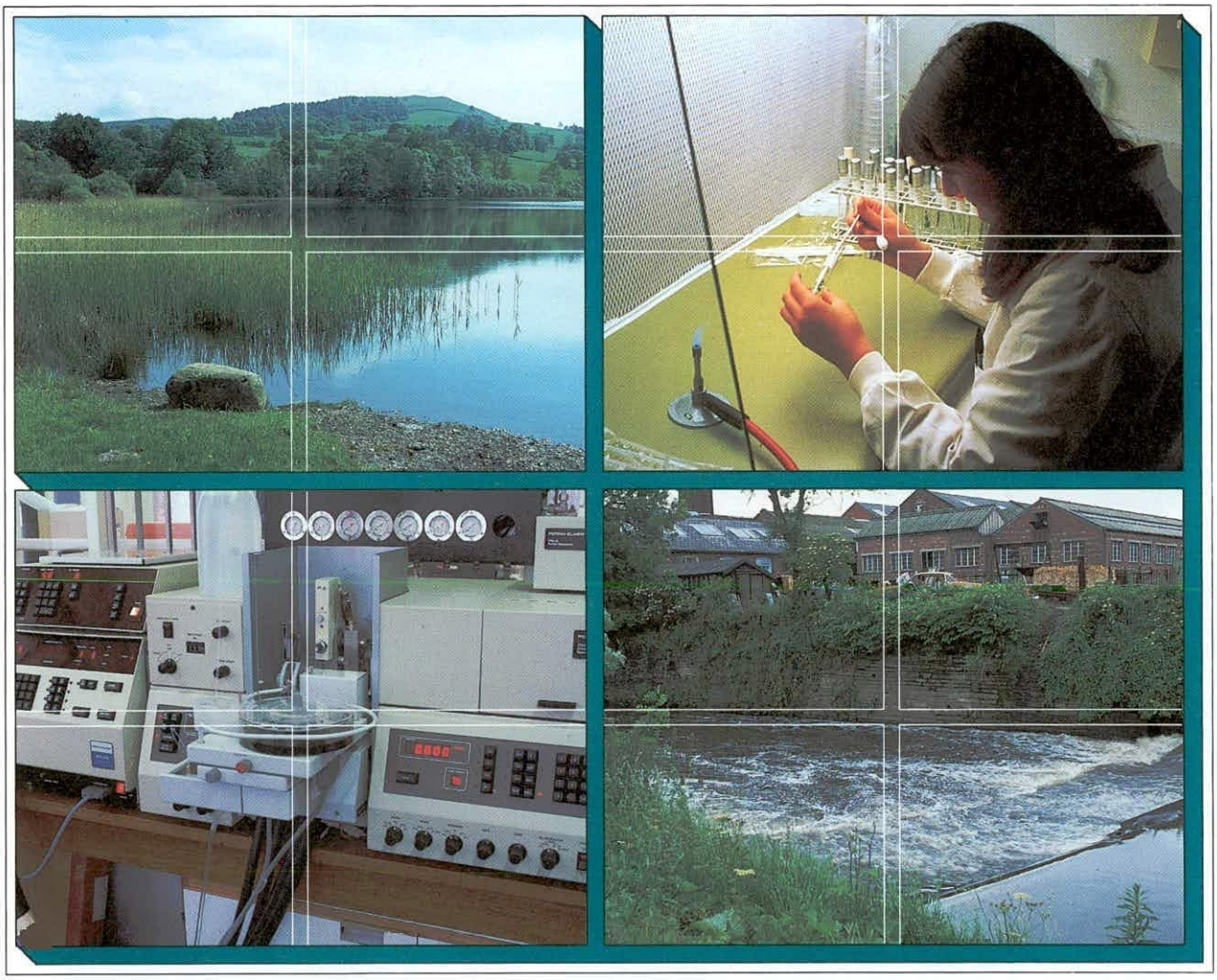
Institute of Freshwater Ecology

REPORT FOR WARMAP SUB-PROJECT 7
TASK 13: ASSESSMENT OF POLLUTION CONTROL

J Hilton

Report To: Aquater
CEH Project No: T04069K9
IFE Report Ref.No: RL/T04069K9/2



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TASK 13: ASSESSMENT OF POLLUTION CONTROL

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Report Date: August 1995
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Report for task 13 : Assessment of pollution control.

Introduction.

In order to develop a plan for maintaining and improving water quality in the upper catchments it is important to know the sources of pollution and their relative importance. In this report the main sources of pollution will be identified and, where possible, quantified. Proposals to maintain or improve the water quality in the upper watershed will be discussed.

Agrochemical product use.

Data on pesticide use have been provided by Uzbekistan, Tadjikistan and Kirgizstan. The data from Kirgizstan, although detailed, were in a different form to those from the other two states and there was not time to compare them. Hence, the rest of the discussion will concentrate on the Uzbek and Tadjik data. An enormous range of pesticides are in use, for example 58 different pesticides were identified in Tadjikistan, and about 50 in the Fergana valley. They are changing all the time as new ones come onto the market or economic considerations make others too expensive. In Uzbekistan (figure 1) the total tonnage has reduced by an order of magnitude over the past five to seven years, although it is most obvious over the past few years. The reduction is, in part, due to a policy of reducing pesticide use for public health reasons and has been accompanied by a move away from class 1 toxic compounds. For Tadjikistan the data are not so recent and, although it is possible to see a reduction in usage in 1990, it is not possible to confirm this as the start of a trend (figure 1). Assuming that the reduction is the same in all the states, there is likely to have been a significant improvement in water quality with respect to pesticides over this time period. Agricultural experts, elsewhere in this report, suggest that for the next few years at least, these low levels will remain. Hence pesticides are likely to reduce as a pollutant of importance, except for the occasional spillage which can have a catastrophic effect for short time periods or over localised areas.

Mining operation statistics.

There are 16 mines in the head waters region of Uzbekistan. Seven gold mines, two coal mines (one with an associated briquette factory), one tungsten , one sulphur mine, one quartz and four limestone quarries. Previously bismuth and tungsten were mined in the region. Many mines have associated concentrating mills and/ or tailings storage. The local experts suggest that the processing of ore causes little pollution but the run-off from tailings is unmonitored, untreated and is heavily polluting. The Almalyk mine alone has accumulate 100 Mt of tailings.

In Kirgizstan there are coal mines at five locations, although discharge data are only given for one area. Waste water from coal mines is treated, although not to standard, but the local experts suggest that the effluents do not pollute. There are a number of polymetallic mines in the Samsar river basin and mercury mines at Chauvai, the Sokh river basin and the Shakhimarda river basin. The Chauvai and Shakhimarda river basins also contain antimony mines. In one of the mercury mines and one of the antimony mines the effluent water is recycled and concentrated wastes are disposed of to the ground and to dry gulleys. It is obvious that this practice must result in pollution to ground if not directly to surface waters. Chauvai mine is certainly the most polluting mine.

It is clear from the submissions that mining in the upper catchments has a significant effect on water quality, at least locally. Almost none of the treatment plants produce effluents reaching their discharge consent standards. However, from the available data it is not possible to obtain a clear picture of the extent of the effect. This is made even more difficult by the fact that, in some of the republics, industrial production information is treated as a state secret and the information is not available to the pollution control authorities. The claims from industry that the discharge of concentrated wastes to the soil surface is not polluting is clearly not sustainable and must result in ground water pollution by high concentrations of toxic substances.

Production statistics of most important industries.

There are no large factories in the upper watershed regions of Uzbekistan. The major light industries, excluding the Angren hydro-power station, include a distribution warehouse, a stone processing plant, a pottery, a winery, 11 cotton gins, a textile factory, a tobacco factory and some service industries. Cattle ranches are also common in the area. However, the largest input appears to be the discharge(s) from the municipal water and waste water facility(s) at Angen.

Although there are a wide range of industries in Kirgizstan the local expert suggests that effluents from the majority of treatment plants do not affect water quality adversely. The exceptions are the Mailisai electric light plant and Djala-Abad treatment works which return high organic matter, suspended solids and petroleum product loads to the Maili-Sun and Changet rivers respectively.

Nine industries have been highlighted as major polluters in Tadjikistan. Chemical production at Tadjikchemprom; the concentrators at Anzov and Andrasman; re-enforcing rod manufacture at Armat; the TadAZ and Takob plants; cement production; Vakhsh nitrogen fertiliser plant and the thermal power station discharge at Dushanbe.

Population estimates of towns and oblasts.

The data on population supplied by the three Republics were all in different formats, making direct comparisons difficult. Data were supplied for four oblast in Uzbekistan, Andijan, Namangan, Fergana and Tashkent. In all cases a significant proportion of the population is in towns and cities and these will constitute the main sources of pollution. In Andijan oblast the dominant town is Andijan with a population of 305.1 thousand. The majority of the rest of the 1951.4 thousand population are dispersed with most towns being less than 20,000. Similarly in Namangan, the regional centre of Namangan has a population of 348.4 thousand. In Tashkent, Akgangaran and Angren have populations of 326.2 and 131.2 thousand respectively, with the rest of the population dispersed. Fergana has 6 cities with populations of 100,000+ with the rest of the population dispersed.

In Tadjikistan, Dushanbe has a population of nearly 600,000. Only Leninabad (160,458) has a population exceeding 100,000. The rest of the urban areas are much smaller than in the Uzbekistan head waters region.

The situation in Kirgizstan is similar to that in Tadjikistan with only the city of Osh having

a population over 100,000 and Djala-bad with a population greater than 50,000. The rest of the population is dispersed with only a few towns exceeding a population of 10,000.

It is obvious that towns with large concentrations of population will create the largest pollution load and this is where the major effort in pollution control should be expended initially.

Negative health effects of existing water pollution.

In Tadjikistan, bacterial pollution of water courses often occurs due to the occurrence of small scale cattle ranches and slaughter houses and the ineffective treatment of sewage from small settlements. Since the majority of rural households (70%) use river or canal water, without treatment, for drinking etc., it is a major cause of disease, particularly intestinal diseases. However, in the Khatlon region alone 280 cases of the often fatal disease leptospirosis were reported in 1993/4. At the other end of the scale the Vakhsh nitrate fertiliser factory, the Yarvan chemical factory and the Tadjik aluminium factory are major polluters of open reservoirs and underground springs with a range of pollutants including: heavy metals , nitrates, nitrites, and fluorides. It is considered that they have a major effect on the health of the local population. However, the main health effects reported for fluoride appear to be due to dust, rather than water transport.

Water in open reservoirs in Tadjikistan is polluted by pesticides, particularly during the periods of application to large field systems and during snow melt. However, it is assumed that this will have reduced in recent times compared to earlier times, although recent measurements still show methlymercaptans, sevin and keltan in the water. Strong correlations have been found between pesticide usage and a large number of diseases, particularly in children.

No data on health effects of existing water pollution were supplied for Uzbekistan. And the local experts from Kirgizstan know of no data referring to their region on this subject. However, it is likely that similar health effects will occur in these regions as in Tadjikistan.

Limitation of water use due to quality.

There are some limitations on use of water for drinking and fisheries, due to standards being breached for a small number of analytical determinands. However, it is not know to what extent this limits economic growth or induces poor public health. Water quality requirements for heavy industry use appear to be very gross and are unlikely to be breached, in the head water regions.

Conclusions.

1. Pesticides have been major pollutants but usage has dropped substantially and they are unlikely to constitute a major problem for the next few years, at least.
2. Mining and ore treatment has a significant effect on water quality in the headwaters. However, with the available data it is difficult to quantify the effect and to rank the pollution in order of precedence for corrective treatment.
3. From the data provided it is difficult to quantify the polluting effect of manufacturing industries although there is evidence that some factories, at least, are significant polluters.

4. There are 7 cities with populations of 100,000+ and two cities with 300,000+ in the Uzbekistan headwaters region; 2 major cities in Tadjikistan - Dushanbe with 600,000+ and Leninabad with 100,00+; and 1 city in Kirgizstan with a population of 100,000+. It is clear that sewage discharges from these major cities will place major pollution stresses on the receiving rivers, at least locally.
5. Bacterial pollution of water courses in rural areas which are subsequently used to supply, untreated, water for drinking is a major source of intestinal disease.
6. Some major polluting industries are considered to have a significant effect on the health of the local population although the extent to which this is caused by water-borne pollution, compared to airborne transport it is not clear.
7. There is a strong correlation between childhood illnesses and pesticide use.
8. There are some stretches of the rivers where drinking water abstraction and fishery standards are exceeded, but it is not clear to what extent this limits economic growth or is a source of public health problems, except for 5 above.

Discussion concerning the present system of managing water quality in the Republics.

Detailed discussions with personnel at Uz-Goskompriroda show that, in Uzbekistan at least, the control and management of water quantity and quality is complex. A simplified organogram of the management structure is given in figure 2. It will have missed some of the subtleties of the system but the underlying message is that the chain of command and control is very diffuse and complex. This is a residual structure of the previous Soviet administration and, since there has been a short time for change to have occurred since the break-up of the Soviet Union, it will be assumed in the following discussion that the structure of the equivalent systems in the other Republics will be similar.

The major difference from Western European structures is the pivotal role of Minvodhos in the management chain. Its function clearly derives from the supply led, command economy of the past and, as such, its role will have to change in the future as consumer capitalism takes hold. In addition to planning for this change, it is obvious to outside eyes that the management of water quality and quantity must be streamlined. Too many ministries and State Committees are directly involved in the management and operation of the water systems (rivers and canals), making stategy development and implementation difficult and cumbersome. A time scale for change should be decided and a strategy should be developed to define and implement a new system. The help of foreign technical experts may be useful to give feed-back on the way water management operates in other countries and how the methods may be applied to the Republics of the Aral Sea basin.

Because of the complexity of the system, it is highly probable that there is some redundancy in the system but, more importantly, important functions fall between ministries/ institutes and are not carried out. One example of this is the medium range control and planning of water quality. Gidromet, through SANIGMI, has a responsibility to act as an independent reporter of water quality trends on a national/ regional scale. Whereas, Goskompriroda looks at the effect on water quality of individual industrial sites. However, there is no-one looking at the additive effect of pollution on medium range water quality changes, i.e. over say the 1 - 50 km scale. A good model to follow to combat this is to incorporate a structure to look at change on a sub-catchment level, i.e. not at the level of the Sur Darya or Amu Darya but at the scale of, say, the Chirchik river system. These groups would be given the responsibility

to develop and maintain detailed data bases for each sub-catchment, along the pattern of the UK National Rivers Authority "Catchment management plan". These data bases would include maps of all abstractions, all point industrial, mining and agricultural discharges with their discharge consents and actual discharges, soil types, geology, population distribution, etc, i.e. all the data required to make rational management judgements concerning the sub-catchment. They would then produce, in consultation with local interested parties, a rolling five year strategy for protecting and improving water quality in the sub-catchment and a plan of works, prioritising, with respect to cost and urgency, such things as necessary research work to clarify the sources of quality problems or to develop solutins, engineering work to structures and effluent clean up campaigns to improve the ecology or flow characteristics etc. This approach would require a some training of both senior staff and middle management and some assistance in implementing the programme (The Institute of Freshwater Ecology, U.K. would be happy to be involved in such a programme.)

<u>Recommendations.</u>

a) Proposals for immediate action.

1) An education programme amongst the mining communities concerning re-use of tailings would reduce the pollution load held in the area. For example, Uzbekistan has a high demand for kaolin but over 5 Mt are discarded each year as tailings by the coal mines at Angren. In Kirgizstan the closure and reduction in production caused by the political and economic changes have reduced the pollution caused by most plants so that there are no urgent measures which need to be made.

2) A cheap and simple small-scale system for purification of water for drinking and culinary use should be developed (e.g. diatomite filters) for use in isolated rural houses, since it will never be possible to maintain river and canal water quality at the microbiological level required for direct use for drinking.

b) Long term strategies for gradual improvement of water quality.

The individual republics have supplied suggestions for long term strategies. These are recorded in appendix 1 and are incorporated into the following.

1. Data on the location, size, and polluting effect (including health) of all discharges should be collected over a realistic time scale. These data should be incorporated into computer data bases and a strategy for the improvement of water quality developed in collaboration with local interested communities. These works are probably best organised on a sub-catchment scale and will require some training and assistance with implementation. (IFE would be happy to assist with this work.)
2. The political structure for the management of water should be restructured to simplify the control of water quality and quantity.
3. A legal basis for charging for water and for breaches in discharge consents should be developed and implemented.
4. A programme of restoration and improvement of sewage and effluent treatment plants should be started immediately on the most seriously polluting discharges. As lesser, but still polluting discharges are identified by the programmes above, a realistic long term programme of improvements should be developed.
5. A programme of education of water users should be introduced to change operating practices in agriculture and industry to reduce water wastage and the likelihood of pollutants being transferred to water courses.

Appendix 1.

Recommendations for improvement of water quality systems proposed by the individual states.

a) Kirgizstan.

It is proposed that the main strategy of Kirgizstan should aim to preserve a dynamic ecological balance in the region with the active participation of the population in the decision making process. This will include:

1) identification of zones of potential ecological disaster.
2) development of measures to prevent and/ or mitigate water pollution.
3) development of maximum permissible loads of pollutants in water.
4) development of methods for assessing the ecological and health impacts of any proposed industrial development.
5) inventory of discharges polluting the water ways.
6) incorporation of new technology into sewage and water treatment plants.
7) development of an operational system of water quality management on a catchment scale using new technologies such as remote sensing.
8) development of a state standard for irrigation water quality.
9) development of an management system for the distribution of water for irrigation, industrial and public supply.
10) development of a legal basis for paying for water.
11) development of legislation to allocate penalties for degradation of the environment.

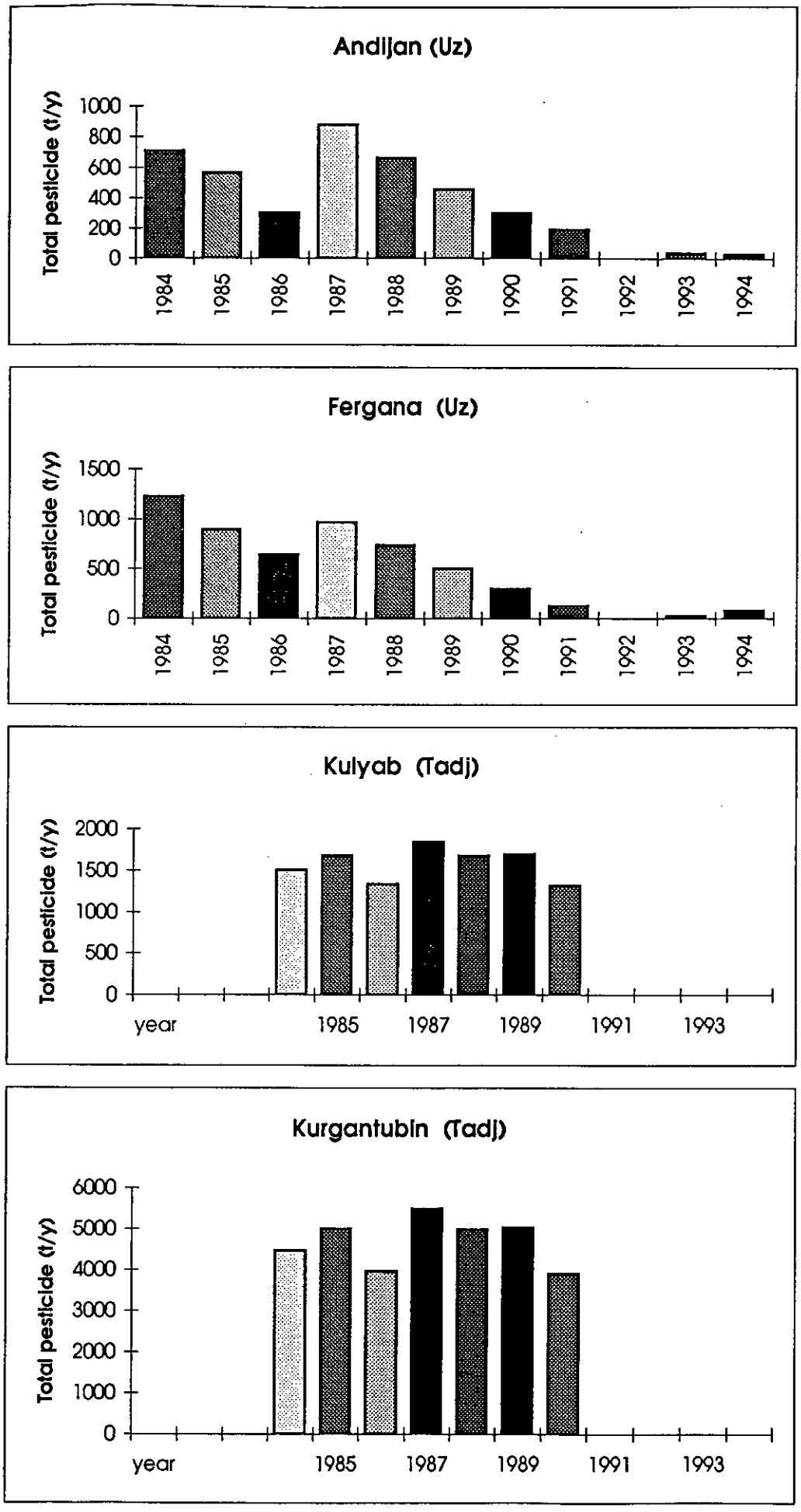
b) Tadjikistan.

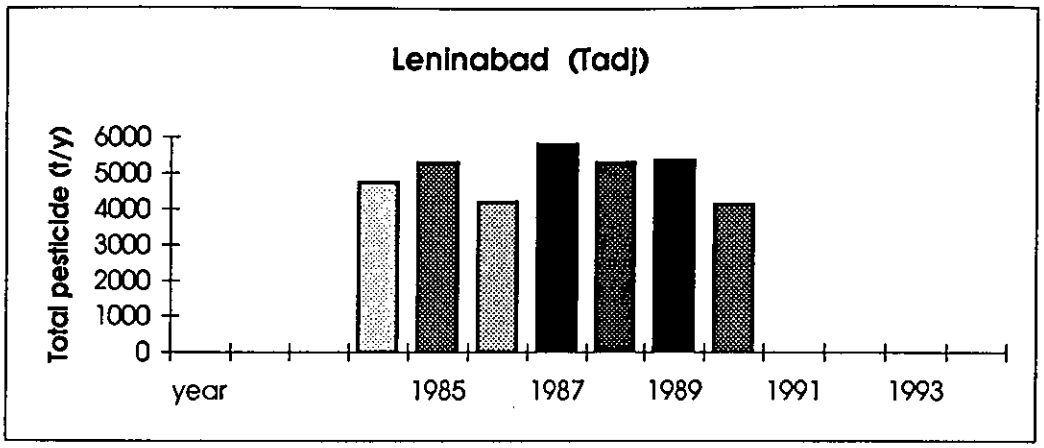
An analysis of data by local Tadjik experts shows that the quality of water in most rivers is generally good. However, irrigation is increasing mineralisation in the these waters which is causing concern. They suggest that the following need to be done:

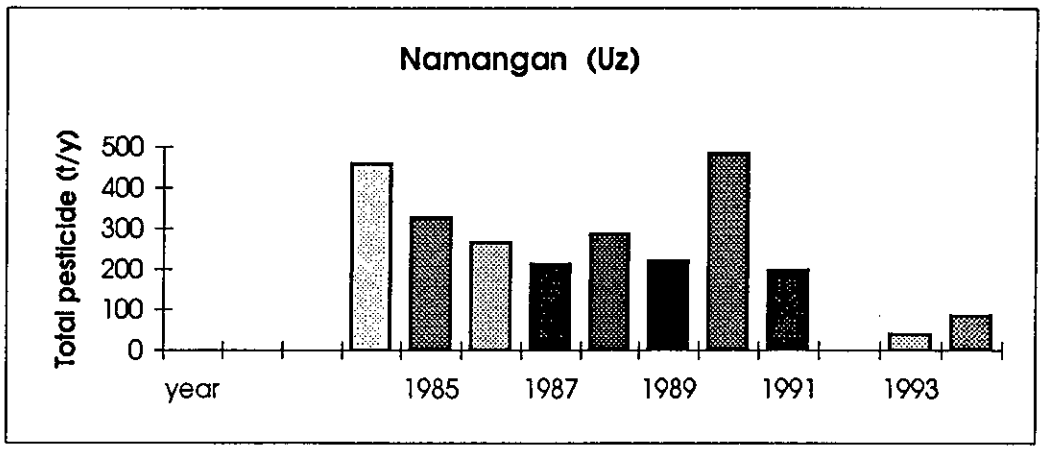
1) Improve the water quality supervision network in Tadjikistan.
2) a programme of improvement and restoration of sewage treatment plants.
3) Application of new technologies to industrial sewage treatment.
4) Introduction of water recycling to reduce water use by industry and agriculture.
5) Improvement of the drainage network.
6) Reduction of pesticide use by strict adherence to application rates and the introduction of biological control methods.
7) Reductions in fertiliser use.
8) Improvements in the quality of effluents discharged to ground waters and surface waters from mining by updating the processes involved.

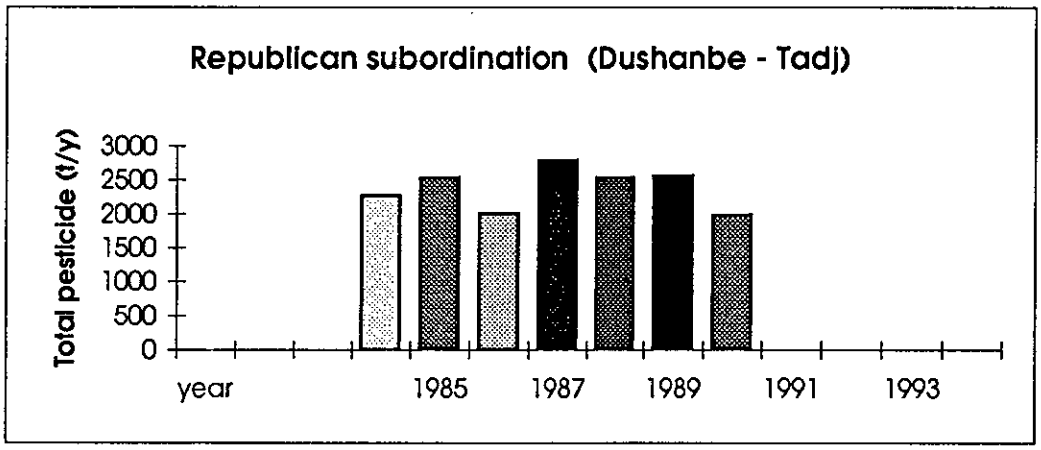
Similar proposal to those above have also been made by Uzbekistan. However, unlike the other two states, in Uzbekistan the worst pollution occurs in the lower plains, not in the muntains. However, even there the same strategies would apply. water consumption by industry should be reduced and both the quality and quantity of effluents discharged should be improved. Local experts propose that an inventory of industry should be made, concentrating in the early stages on mining, and prioritise the plant in order of their pollution effect on water. This will allow a systematic plan for investment to be developed. However, it is clear that the mines at Almmalyk, Angren, Akhangaran, Altyn-Terkan and Ignichky will be high on the list.

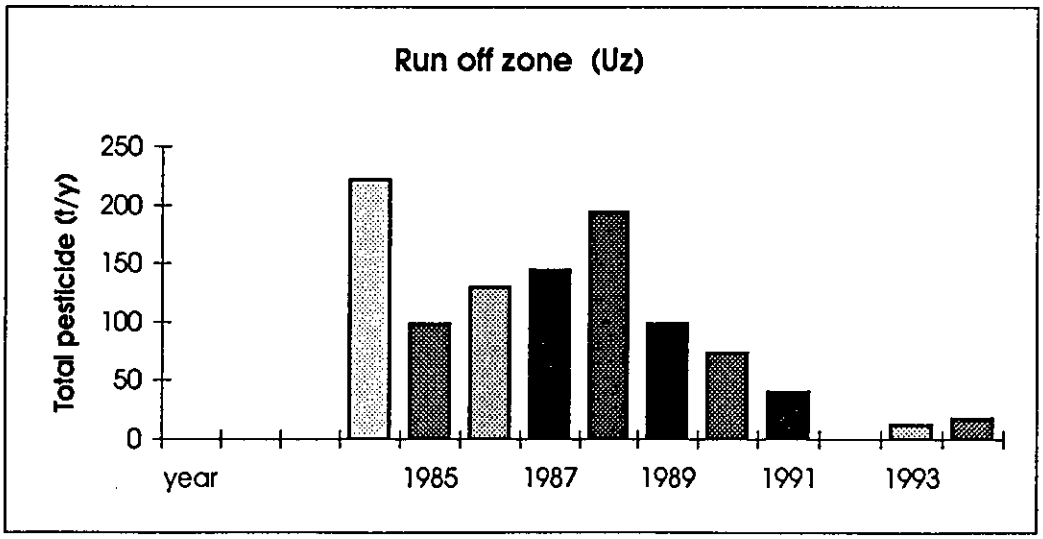
Figure 1. Pesticide usage in different regions of the upper watersheds.

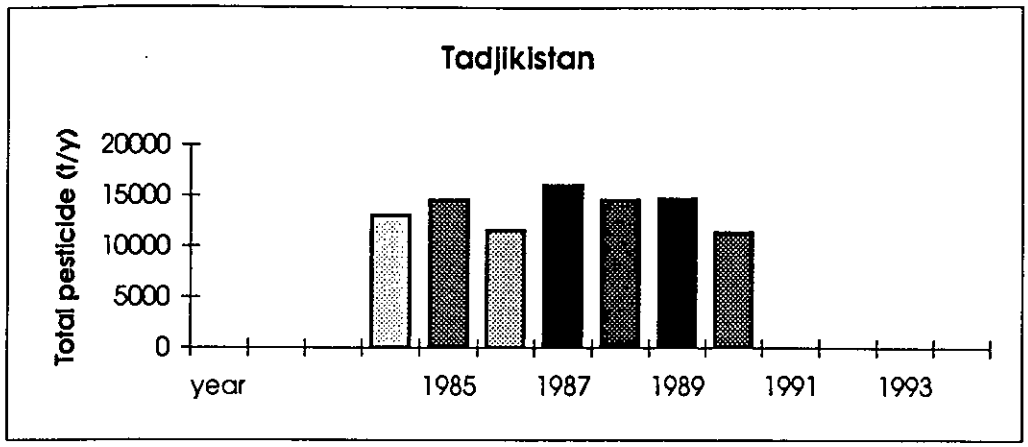



Leninabad (Tadj)
Total pesticide (t/y)
6000
5000
4000
3000
2000
1000
0
year
1985
1987
1989
1991
1993


Namangan (Uz)
Total pesticide (t/y)
500
400
300
200
100
0
year
1985
1987
1989
1991
1993


Republican subordination (Dushanbe - Tadj)
Total pesticide (t/y)
3000
2500
2000
1500
1000
500
0
year
1985
1987
1989
1991
1993


Run off zone (Uz)
Total pesticide (t/y)
250
200
150
100
50
0
year
1985
1987
1989
1991
1993


Tadjikistan
Total pesticide (t/y)
20000
15000
10000
5000
0
year
1985
1987
1989
1991
1993

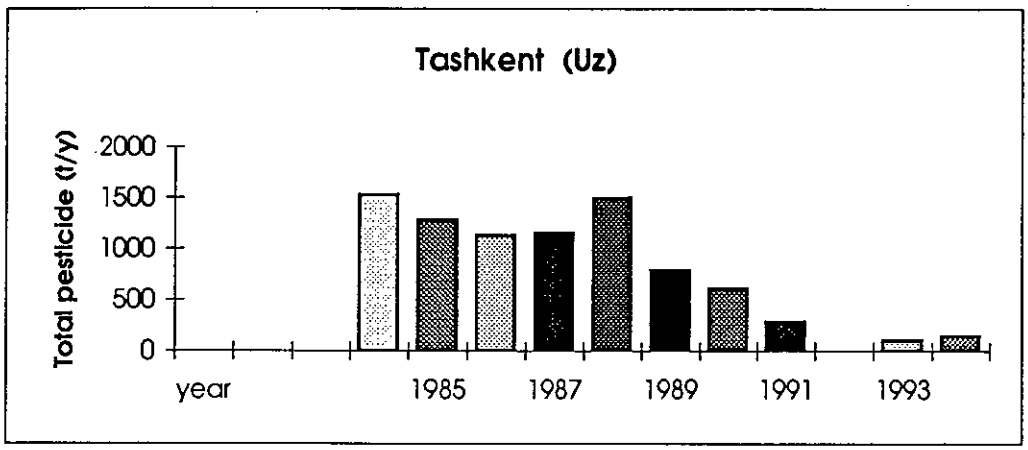
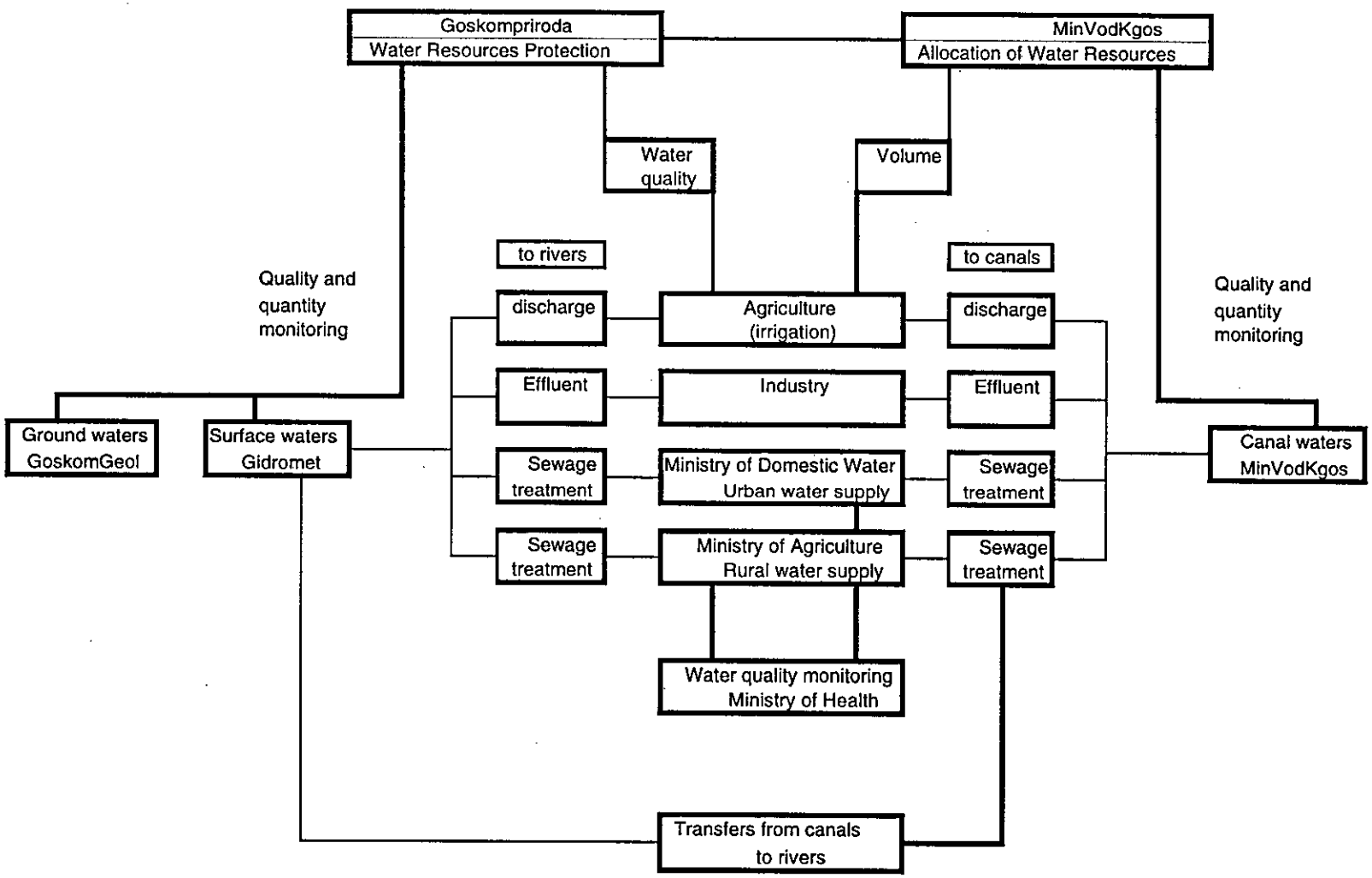

Tashkent (Uz)
Total pesticide (t/y)
2000
1500
1000
500
0
year
1985
1987
1989
1991
1993

Figure 2. Organogram of water quality and quantity management in Uzbekistan.

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