ONCHOCERCIASIS CONTROL PROGRAMME IN THE VOLTA RIVER BASIN


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Note: This document is made available together with the Long-Term Strategy (LTS) proposal (JPC.5.7(OCF/84.4)) to allow readers of that proposal who wish to acquaint themselves with the Programme in some detail, to do so in a convenient manner (see paragraph 5.2 of the LTS document).
ONCHOCERCIASIS CONTROL PROGRAMME IN THE VOLTA RIVER BASIN AREA

1. Historical perspective of events leading to the start of the Programme

1.1 Since the mid-1950s several attempts at controlling the transmission of onchocerciasis were made in circumscribed areas in Equatorial and West Africa with varying degrees of success. These localized operations aimed at blackfly control through the application of larvicides at breeding sites in rivers, except for one or two areas where DDT was used as an adulticide. Larviciding was mainly carried out from the ground until 1975 when the Onchocerciasis Control Programme (OCP) introduced the use of fixed-wing aircraft and helicopters for this purpose. During the 1960's ORSTOM\textsuperscript{1} entomologists, assigned to OCCGE\textsuperscript{2}, carried out a series of experiments on larviciding techniques and their effectiveness in areas covering parts of Upper Volta, Mali and the Ivory Coast with the financial support of the European Development Fund (EDF) and of the French Aid and Cooperation Fund (FAC). This work led to the start in 1962 of an onchocerciasis control operation in the same areas including the Farako zone which, excepting brief interruptions, continued, with EDF support, until 1975 at which time control operations were taken over by OCP. The work of the UK Medical Research Council team in Cameroon on epidemiological survey methods and strain differences in Onchocerca volvulus also helped to lay the foundation for the technical approach of OCP. Furthermore, WHO supported onchocerciasis control projects in West Africa provided useful field experience for the conduct of the Programme.

1.2 With the growing concern about the serious adverse effect of onchocerciasis on human health and on socioeconomic development in extensive parts of West Africa and the recognition that control of transmission of the disease was a distinct possibility, it was decided to convene a Joint USAID\textsuperscript{3}/OCCGE/WHO Technical Meeting on the Feasibility of Onchocerciasis Control which was held in Tunis, Tunisia from 1 to 8 July 1968. The meeting concluded that a large-scale Simulium control scheme for the purpose of reducing the prevalence and intensity of onchocerciasis among the people living in the savanna zone of West Africa was feasible, following which

\textsuperscript{1} Office de la Recherche Scientifique et Technique Outre-Mer.

\textsuperscript{2} Organization de Coordination et de Coopération pour la lutte contre les Grandes Endémies.

\textsuperscript{3} Agency for International Development of the United States of America.
the governments of seven countries\(^1\) in that geographical area submitted requests to a number of intergovernmental and bilateral agencies (including UNDP, FAO, WHO, IBRD, EDF and USAID) for support in the preparation of a strategy for an Onchocerciasis Control Programme in the Volta River Basin area and for eventual assistance to the implementation of this programme.

1.3 Subsequently, a mission was set up to prepare an overall strategy for the Onchocerciasis Control Programme. The report of the PAG Mission\(^2\) was submitted late 1973 to a meeting of representatives of the Participating Countries in West Africa, of potential donor countries and of the intergovernmental agencies concerned. The proposed strategy, covering a period of 20 years, and the technical recommendations were approved and funds committed for the initial phase of operations of the Onchocerciasis Control Programme in the Volta River Basin area for which WHO was appointed the Executing Agency.

2. Management of the Programme

2.1 The overall direction of the operational and budgetary policies of OCP rests with the Joint Programme Committee (JPC) which normally meets once a year and is composed of representatives of the Participating Countries, of Donor Countries and Donor Agencies, and of the four Sponsoring Agencies (FAO, UNDP, WHO and the World Bank). JPC exercises general supervision of the planning and execution of the Programme, examines the annual progress report of the executing agency (WHO) as well as other reports submitted to it, considers the plan of action proposed for the following year and approves the corresponding budget.

2.2 In each one of the Participating Countries a National Onchocerciasis Committee (NOC) has been established with a view to ensuring liaison between the Programme and the national authorities concerned and in order to promote, within their respective countries, activities which are supportive of OCP. A meeting of representatives of all National Onchocerciasis Committees is normally held once yearly.

2.3 An Expert Advisory Committee (EAC) with a membership of 12 scientists, coming from disciplines of direct relevance to OCP operations, carries out technical audit of OCP and furnishes technical and scientific advice to the Director of the Programme, as and when required, and to the Joint Programme Committee. EAC convenes at least once a year. The Ecological Group (five members) although having an independent status is a sub-group of EAC through which it reports to JPC.

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\(^1\) Benin, Ghana, Ivory Coast, Mali, Niger, Togo and Upper Volta.

\(^2\) The Preparatory Assistance Mission to the Governments of the Participating Countries.
2.4 Representatives of the four Agencies involved in the Onchocerciasis Control Programme meet four or five times a year as the Committee of Sponsoring Agencies (CSA). The role of CSA is, inter alia, one of preparing documentation of issues faced by OCP, assessing the capacity of the Programme to resolve these issues, and to make recommendations to JPC in order to assist that Committee in its decision-making process.

2.5 The Programme Director is responsible for all OCP operations; for the preparation of plans of action and corresponding work programmes; for the reporting on Programme activities; for the preparation of the Programme budget document; and for maintaining a continuing contact and dialogue with the governments and agencies concerned, as well as with the scientific community. To accomplish these tasks the Director is supported at the OCP Headquarters in Ouagadougou, Upper Volta, by four technical units (Vector Control, Epidemiological Evaluation, Socioeconomic Development Support and Administration and Management) each headed by a chief assisted by operational/scientific and general service staff. The major part of vector surveillance and control operations is carried out through a network of six OCP sectors and 24 sub-sectors while the epidemiological evaluation is conducted by two mobile teams based in Ouagadougou. In 1983 there were 56 professional and 750 general service posts within the Programme.

2.6 The management structure described in the preceding paragraphs (organigramme attached as Annex 1) has remained essentially unchanged since the start of Programme operations, except that before 1980, the functions of the Joint Programme Committee were carried out by the Joint Coordinating Committee (JCC) having the same membership as that of JPC and presided over by an independent chairman; the duties of EAC were performed by a Scientific and Technical Advisory Committee (STAC) whose members were appointed from a Scientific Advisory Panel, now disbanded; a Steering Committee, set up by the Executive Heads of the four Sponsoring Agencies, was concerned with those issues now being dealt with by CSA.

3. Geographical coverage

3.1 The definition by the PAG Mission of the area in which OCP operations would be conducted was originally (1973) arrived at from two considerations, namely that the disease vector, the blackfly, was able to travel long distances, i.e. 150 km or more (now known to be considerably in excess thereof) and that the Programme would be confined to the control of savanna-onchocerciasis. The latter determining factor was based on the assumption that the presumed "forest strain" of Onchocerca volvulus, which gave rise to clinically less serious disease manifestations (in particular eye lesions) than the "savanna strain", could not establish itself outside forest areas and there act as an agent of the savanna-type of onchocerciasis. Also, it was taken for granted that the "savanna strain" of the parasite could not survive in forest zones.

3.2 The original OCP area covered 640 000 km² of Sudan and guinea savanna in Benin, Ghana, Ivory Coast, Mali, Niger, Togo and Upper Volta. The boundaries of the OCP area coincided in the north and north-east with the limits of the distribution of the disease vector; to the south with the beginning of the forest zone; and to the west and east essentially with national borders. It was expected that by conducting Programme operations in such a large area, the risk of serious adverse effects of reinversion would be virtually obviated.
3.3 The launching of Programme operations was staggered within the area as follows: Phase I (geographical) started in February 1975, Phase II in March 1976, and Phase III in March 1977. (The map in Annex 2 shows the geographical Phases of the Programme.) As early as 1976 it became apparent that the problem of external reinvasion of infective blackflies might pose a threat to the successful outcome of OCP operations. In order, therefore, to combat the reinvasion of blackflies from breeding sites located outside the OCP area and also, at the request of the Ivory Coast, to control some foci of severe onchocerciasis, the Programme's southern border was redefined with the result that operations were started in 1978/79 within an additional 110 000 km², situated in the south of the Ivory Coast (see geographical Phase IV on map in Annex 2) thus bringing the total OCP area to 764 000 km².

4. Vector control: entomological surveillance and larviciding

4.1 Savanna blackflies (Simulium damnosum s.s./sirbanum) are the exclusive cytospecies in all of Upper Volta (excepting the south-western part of the country where forest species (S. soubrense) are found); in most of that part of Mali which is included in the Programme area; in the northern half of Ghana; in the OCP sector on Niger; and in the north of Togo and Benin. The forest species, S. soubrense/sanctipauli, are found together with S. damnosum s.s. in those areas of Mali and Upper Volta which border on the Ivory Coast; throughout the Ivory Coast; in the south-east of Ghana; and in the north of Togo. The majority of the blackflies caught in the Extension area of Benin and Togo cannot be routinely identified as belonging to one or another species.

4.2 The area in which the savanna species are the only vectors is today characterized by very low ABR/ATP¹ levels and, indeed, at several catching points by the total absence of blackflies for a number of years. In the remaining parts of the OCP area, i.e. in the western and eastern border zones, in parts of the south of the Ivory Coast and Ghana, and in the Southern Extension area, the blackflies are present in numbers which frequently give rise to ABR/ATP values exceeding the levels of tolerability.

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1 Annual Biting Rate: The number of blackfly bites a person would receive if he or she were to sit at the river bank for eleven hours a day, 365 days a year. The level of tolerability has been set at an ABR of 1000.

Annual Transmission Potential: The number of infective larvae which might have been transmitted to the person under I above by the biting flies. The level of tolerability has been set at an ATP of 100.
4.3 The technical approach to onchocerciasis control in the Programme area, as determined by the PAG Mission and implemented by OCP, is based on vector control and the subsequent interruption of disease transmission. This control consists of aerial application of insecticides in order to kill the blackfly in its larval stages at breeding sites in fast flowing rivers and in large streams. The frequency and intensity of larviciding are determined weekly on the basis of findings reported through the entomological surveillance system. The application of larvicides from the ground has so far been carried out on a limited scale only.

4.4 As the prospect of effective mass-treatment of clinical onchocerciasis cases was rather remote at the time of submission of the PAG report, the Preparatory Assistance Mission felt at that time that a period of 20 years' "very high level control" of S. damnosum in the OCP area would be necessary as "the cumulative lifespan of adult Onchocerca volvulus filariae and of the last microfilariae produced by these adults (was) in the region of 16 to 18 years".1

4.5 The phenomenon of "exogenous" reinvasion of blackflies (from sources outside the OCP area) has tended to follow a fairly uniform pattern during the past few years. In the west, reinvasion starts gradually during the months of April and May/June (moving in an east north-easterly direction), while it comes later in the east. On both sides the peak falls in June/July before the disappearance sometime during the month of August.

4.6 The annually reinvaded areas are located in the western part of the Mali section of the present OCP area; in the north-western Ivory Coast; and in the northern parts of Benin and Togo. The external sources of migration are found in Guinea in the west and in the Southern Extension area in the east with a possible influx in Benin from Nigeria. The invading blackflies all belong to the group of savanna species (S. damnosum s.s./sirbanum) except in Togo where the migrating blackflies also include the S. squamosum species. There was no reinfection (from sources within the Programme boundaries) during 1983.

4.7 The problem of blackfly resistance to organophosphorous larvicides is geographically limited to the Atlantic basins in the Ivory Coast, although a reduction in susceptibility of forest species (S. soubrense/sanctipauli) has spread into southern Ghana where the rivers are left untreated.

4.8 With a fairly localised exception, resistance has been confined to the forest species and it has thus been possible to continue the use of temephos2 in more than 75% of the OCP area. The above mentioned exception was in the lower Bandama river basin where in 1983 the savanna species pair S. damnosum s.s./sirbanum exhibited a six to seven times reduction of temephos susceptibility. The problem was overcome by the use of Bacillus thuringiensis H-14 (Teknar)3.

4.9 The use of chlorphoxim as a replacement for temephos in the control of Abate resistant forest species has led to cross-resistance as both compounds belong to the group of organophosphorous larvicides. However, after a season of non-treatment by Chlorphoxim, that particular insecticide reasserts its effectiveness as a larvicide against forest species until, after about three months, resistance re-emerges. This is in contrast to resistance to temephos which is very stable.

1 PAG report, page 43.
2 Temephos = Abate.
3 Teknar = one of the formulations of B.t. H-14.
4.10 B.t. H-14 is used during the rainy season in rivers affected by resistance to organophosphorous larvicides as long as the discharge rate does not exceed 50 cu.m./sec. which is the upper operational limit for its use. Above that limit Chlorophoxim is substituted for Teknar.

4.11 A special measure, introduced in 1983, has been the attempt to neutralize the Simulium reservoirs at the lower Bandama river (Ivory Coast) by the application of high doses of Teknar during the dry season (weeks 12 to 27) in order to impede the population explosion and the spread of blackflies before the wet season. The result of this experiment ("operation clean-up") turned out to be quite encouraging. An important additional justification for the operation was the fact that resistance to Abate had been detected in savanna species prevalent along that particular section of the river.

4.12 The information and data required for directing aerial operations and monitoring the situation as regards vector control are provided by the entomological surveillance network. The total Programme area is divided into six sectors made up of 24 sub-sectors.

4.13 During the rainy season, somewhere around 24,000 km of river, including the Southern Extension area, are under OCP entomological surveillance. The number of river kilometres actually treated by larvicides obviously varies appreciably from the wet to the dry season, during the latter reaching a level of only a few hundred km. Eight Hughes 500 helicopters, one large Bell 204 helicopter and two fixed-wing aircraft operate during the wet season.

4.14 The control of the effect of aerial operations is carried out at 230 capture points used for ABR/ATP calculations within the treated Programme area to which should be added 46 points in the Southern Extension area. During the wet season 286 sites were visited once a month by entomological surveillance staff in order to check for the absence/presence of blackfly aquatic stages in rivers treated; to capture blackflies when present; and to read water gauges, all with a view to providing the data necessary for directing aerial operations.

4.15 Vector control from the ground is carried out in the Bandiagara area near the Niger river in Mali. Regular blackfly control and weekly searches for larvae are made by two OCP teams with the support of village health workers who have been trained for that purpose by the Programme. All breeding places found to be "positive" are treated manually with larvicide.

5. Epidemiological evaluation and disease control

5.1 Data pertaining to the incidence, prevalence and community load of infection concerning onchocerciasis are obtained by repeated examination of populations in preselected indicator/evaluation villages. Such examinations are either simple evaluations (microscopical examinations of skin-snips, clinical and simple visual testing) or detailed evaluations (ophthalmological examination added). In addition, onchocerical nodules and adult worms are excised and examined to determine the longevity of the female as well as its immunological properties.

5.2 The overall geographical distribution of onchocerciasis by levels of endemicity in the Programme area at the time immediately preceding the start of OCP operations showed extensive hyperendemic areas (prevalence rates more
than 60%) between the Red and White Volta Rivers above and below the border between Ghana and Upper Volta; along the Sissili River and its tributaries in Ghana; in the north-eastern regions of the Ivory Coast adjacent to the Black Volta; and around the White Bandama and Bou Rivers in the north-central parts of the Ivory Coast. Towards the more arid regions in the north of Upper Volta, the prevalence levels decreased gradually. A similar, but less pronounced tendency of declining infection rates prevailed when moving towards the east and west from the heartlands of the Volta River basin. The southern border of the savanna-type of onchocerciasis merged gradually with the endemic foci of the "forest-type" of the disease. On the whole, epidemiological findings played an important role in determining target areas for OCP activities. The PAG mission estimated that out of a total population of 10 million, in the original Programme area more than one million suffered from onchocerciasis including up to 100 000 cases of severe eye lesions of which at least 35 000 were blind.

5.3 The distribution and prevalence of blindness corresponded relatively well with the endemicity levels of onchocerciasis. In areas where the disease was hyperendemic, the blindness rates reached 4% or more, in meso-endemic zones (35-60% infection rates) they oscillated between 2% and 4%, while in hypo-endemic communities (below a prevalence rate of 35%) the rates dropped to the level of 0.5 to 2%.

5.4 The statistical unit at OCP HQ (see paragraph 6.1 below) has recently introduced the concept of the mean microfilarial load of a cohort of adults (community load of infection) as an indicator of the intensity of infection. This indicator is considerably more sensitive than the prevalence rate when it comes to detecting a decrease in the number of adult worms in a previously hyper-endemic population having been exposed to the effect of vector control for some time. The difference between the sensitivity of the two indicators is less marked in meso- and hypo-endemic areas.

5.5 The downward trend in the prevalence of onchocerciasis within the Programme area, which is now apparent, will become increasingly discernible over the next five years. While epidemiological findings have so far had limited impact on day-to-day decisions regarding the direction of Programme control activities, there can be little doubt that such findings will come to play an ever increasing role in the operational decision-making process.

5.6 Somewhere around 75 villages (ab. 300 inhabitants each) are visited each year (60 for simple and 15 for detailed examination).

5.7 The control efforts of the Programme have been almost entirely concentrated on larviciding. Until the present time there is no drug available which is sufficiently effective and safe to be used for large-scale selective population chemotherapy. Diethylcarbamazine (DEC-C) is a microfilaricide with a rather short-lived effect and causing intense reactions as a result of killing microfilariae. DEC-C is, therefore, not suitable for mass-treatment which is also the case for Suramin, a macro-filaricide, which gives rise to severe side-effects essentially due to a high level of toxicity.

1 The total population of the present (1984) Programme area (including the southern part of Ivory Coast) is estimated at 15 million.
6. Statistical Analysis

6.1 An important aspect of the monitoring of control activities and of the field research programme is the statistical analysis of operational data and statistical support to the planning and implementation of the various research activities. The OCP biostatistician thus plays a major role in ensuring that individual research proposals are planned and executed in a coordinated manner, according to priority needs of the Programme, and that the analysis of research/operational data and the conclusions drawn therefrom become available as early as possible, a task which is facilitated by the recent installation of a computer in OCP/HQ.

7. Ecological monitoring

7.1 The surveillance of the hydrobiological environment in terms of detecting any possible adverse effects of new or currently used larvicides employed in the control of onchocerciasis has already for some years been the operational responsibility of three Participating Countries, i.e. Ghana, Upper Volta and the Ivory Coast. Similar activities are carried out by the governments of Benin and Togo in their respective sections of the Southern Extension area. Each country has established its own team for the purpose of ecological monitoring within its national boundaries.

7.2 The role of OCP in this field is one of coordination and the initial detection of possible adverse effects of new larvicides being tested. The Programme also enters into contracts with national institutes responsible for hydrobiological data collection and analysis.

8. Socioeconomic development

8.1 The adverse effect of onchocerciasis on socioeconomic development is implicitly referred to in the overall Programme objective defined by the Expert Advisory Committee (EAC). The monitoring of any population movements which could be ascribed to the successful operations of OCP and the impact of such movements on the populations concerned have therefore received due consideration by the Programme. OCP HQ receives regular reports from the Participating Countries on their socioeconomic development, with particular emphasis on that occurring in "oncho-controlled" areas, which are presented to the constituent bodies of the Programme.

8.2 As a corollary to the reduction in onchocerciasis transmission brought about by the control of blackflies, the Programme has been instrumental in enhancing socioeconomic development among populations of the OCP area through the "liberation" of fertile land, which had previously been deserted due to a high endemicity of the disease.

8.3 Obviously, the planning for and implementation of programmes for repopulation of "oncho-controlled" areas is the prerogative of the Participating Countries concerned. The role and activities of the OCP Socioeconomic Development Unit have consequently been oriented towards the collection, analysis and dissemination of information on developments in this sphere within the Programme area, the conduct of special studies for the benefit of OCP countries, and support to governments in their efforts to improve the social and economic conditions of populations moving into previously "oncho-infected" areas.
9. Training

9.1 In the early days of the Programme, the main emphasis as regards training was on the preparation of nationals, essentially from the Participating Countries, to assume operational responsibilities as OCP Staff Members. This, however, did not preclude the training in onchocerciasis control and related fields of nationals employed in their own countries. The orientation has been towards the strengthening of countries' support to the Programme and of their capability to eventually support the devolution process and to carry out former OCP activities. A limited number of fellowships have also been awarded to OCP staff members to study and familiarise themselves with certain special techniques and procedures of particular interest to the Programme. The training has increasingly been carried out within OCP itself or in institutions located in West Africa. Only in highly specialized fields are fellowships being awarded for studies outside the Programme area. In a few cases have fellows from other, non-OCP, countries been admitted as trainees and assigned for shorter or longer periods to Programme operations of particular interest to them.

9.2 The OCP training programme has addressed itself to three categories of health- and health-related manpower from Participating Countries (and in a few cases from within the Programme staff itself), namely professionals (physicians, entomologists, hydrobiologists, economists, etc.); technicians; and administrators.

9.3 The majority of fellowships and in-house training has been given in the field of entomology and vector control with particular emphasis on hydrobiology. Physicians and nurses have received post-graduate training in such fields as ophthalmology, parasitology, biostatistics, economics and highly specialized examination and study techniques. Annex 3 presents in a tabular form the number of fellowships granted since the inception of the Programme by subjects studied and by fellows' countries of origin.

10. Research

10.1 It was understood from the start of the Programme that continuing research would be required in respect to the identification, lifecycle, reproduction and transmission of Onchocerca volvulus; the pathology, diagnosis, treatment and epidemiology of the disease; and the identification, reproductive behaviour, flying/resting patterns, vector capacity and control of the various Simulium cytotypes. Furthermore, as the Programme has developed it has been supported by ongoing operational research concerned with such issues as treatment schedules, aerial and ground transport, improvement of spraying equipment, blackfly trapping and organisation of entomological surveillance.

10.2 A great deal of the research is carried out in the OCP area by the Programme's scientific and operational staff, with or without the assistance of consultants, but use is also made of collaborating institutions and laboratories, within or outside the Programme area, which undertake to investigate specified problems under contract with OCP. A special case is the Onchocerciasis Chemotherapy Project which is being implemented in close collaboration with TDR and the pharmaceutical industry. A fruitful collaboration has also been established with the chemical industry in the search for new larvicides and improved formulations of those currently in use.

1 WHO/UNDP/IBRD Special Programme for Research and Training in Tropical Diseases.
11. Budgetary and financial aspects of the Programme

11.1 The financing of the Onchocerciasis Control Programme is borne by a number of governments of countries situated outside the OCP area, by certain international development banks, and by organisations/specialised agencies belonging to the United Nations system. All contributions are paid into an Onchocerciasis Fund which is administered by the World Bank. A separate source of financing is provided by the Participating Countries at the level of 1% of the annual budget estimates.

11.2 A Plan of Action and Budget is presented annually to the Joint Programme Committee for approval on the basis of which funds are secured for the subsequent year. Every quarter the Programme Director draws from the Fund the amounts required to support the operations. The OCP expenditure is subject to the same internal and external audit as WHO while the OCP Fund itself is audited by the World Bank's external auditors.

11.3 In 1973 the PAG Mission estimated that the Programme would require funding at a level of $120 million over 20 years (1974-1993). Of this sum, $14 million would be required for the first financial Phase (1974-1979). Thereafter expenditure was estimated on an annual basis, that is $5.8 million per annum for the period 1980-1983 and $5.6 million per annum for the period 1984-1993.

11.4 It is interesting to compare the Mission's estimate of expenditure with actual expenditure during the first ten years of the Programme. Measured in terms of 1980 US dollars, the Mission estimated an expenditure of $119.2 million for the period 1974-1983. Actual expenditure for this same period was $134.7 million. Thus, for a ten year period, actual expenditure has exceeded estimated expenditure by only 13%.

11.5 In 1974 the Programme was financed by only six Donor Countries, UNDP and the World Bank. Now, there are 13 Donor Countries, plus development banks, foundations and international organizations. (Annex 4 lists the current (1984) donors).

11.6 The total budget approved for 1984 amounts to US$ 24 202 000

Annex 5 shows the distribution of the budget by Programme activities.
12. Summary of results and achievements

12.1 The changes in the entomological situation due to OCP operations have been impressive. Measured by the Annual Biting Rate (ABR) and the Annual Transmission Potential (ATP) there has been a remarkable regression in the density of onchocerciasis throughout the original OCP area, except in those peripheral zones which are subject to reinvasion of Simulium s.l. (Annex 6 illustrates ATPs at catching points: before Programme operations and in 1983.)

12.2 The findings of longitudinal ophthalmological investigations over 7-8 years, and in particular the now very low-level of invasion of the eye of microfilaria (mf), confirm the reduction in transmission of the disease. Of those who initially showed ocular microfilariasis, 70% have now improved/recovered while there was no change in 15%, and deterioration in 10-30% of the cases (depending on the invasion load). In virtually all those suffering from punctate keratitis the lesions have healed spontaneously; two-thirds of early stage ocular lesions have stabilized/improved, with 5% of the subjects having proceeded to blindness, as did 7% of the advanced lesions.

12.3 A particularly reliable indicator for measuring the epidemiological impact of the Programme is the incidence of infection and disease among children born since the start of control operations. Recent investigations have demonstrated that in 90% of the original OCP area, this group of children has been without risk of contracting onchocerciasis. The prevalence trends observed during the time interval between the pre-control era and 1983, by different age-groups, are illustrated in Annexes 7 to 9.

12.4 The use of the mean microfilarial load index in the statistical analysis of epidemiological evaluation data has made it possible to draw regression lines in respect to the levels of intensity of infection over defined periods of time, both for initially hypo/meso-endemic and hyper-endemic populations. Practically all such regression lines converge at zero at a point of time situated around 11 years after the interruption of transmission. The implied assumption, that the average longevity of the adult worm is in the neighbourhood of 11 years has received support by the findings of laboratory studies on the mortality of macrofilariae.

12.5 As long as onchocerciasis persisted in highly exposed, hyperendemic communities, it would give rise to blindness at an early age (mean: 39 years) when the victims would normally be at the peak of their productive lives. The blind persons became an economic liability to the community and would, themselves, suffer a 13 to 15 years reduction in life expectancy. It has been estimated that as a result of Programme operations, 27,000 people have been saved from going blind in Upper Volta alone.
OCP Organigramme

Programme Director

Administration and Management
- Personnel
- Admin. Services
- Transport Management

Epidemiological Evaluation
- Team 1
- Team 2

Vector Control

Applied Research

Economic Development

Aerial Operations

Entomological Evaluation

Supplies

Budget and Finance

Ophthalmic Team

Zone West
3 sectors
11 subsectors

Zone East
3 sectors
1 group
13 subsectors
Start of Programme Operations by Geographical Phases

- boundary of present (1984) OCP area
- boundary of Geographical Phases
- boundary of Southern Extension area
### Distribution of OCP Fellowships by Subjects studied and by Fellows' Countries of Origin
(cumulative until end of 1983)

Répartition des bourses OCP classées par sujet étudié et par pays d'origine des boursiers
(cumulative jusqu'à la fin de 1983)

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<th>Hydrobiology</th>
<th>Parasitology</th>
<th>Ophthalmology</th>
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- BN: Benin
- GB: Guinée Bissau
- ML: Mali
- SN: Senegal
- TN: Tanzanie
- WH: OMS/WHO
- CI: Côte d'Ivoire
- GC: Guinée (Conakry)
- NG: Niger
- SL: Sierra Leone
- TG: Togo
- GH: Ghana
- HV: Haute Volta
- NR: Nigeria
- SU: Soudan
- UG: Ouganda
List of Donors to the Onchocerciasis Control Programme
Liste des donateurs au Programme

Belgium/Belgique
Canada
France
Germany, Federal Republic of/Allemagne, Republique Federale d'
Italy/Italie
Japan/Japon
Kuwait/Koweit
Netherlands/Pays-Bas
Norway/Norvège
Saudi Arabia/Arabie Saoudite
Switzerland/Suisse
United Kingdom of Great Britain and Northern Ireland/Royaume-Uni de Grande-Bretagne et d'Irlande du Nord
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United Nations Development Programme/Programme des Nations Unies pour le Développement
The World Bank/La Banque Mondiale
World Health Organization/Organisation Mondiale de la Santé

1984
Distribution of the Budget by Programme Activities

1984 - $ 000

- Epidemiological Evaluation $850 (3.5%)
- Economic Development $304 (1.3%)
- Applied Research, Environmental Monitoring, Data Processing and Training $2,666 (11.0%)
- Chemotherapy $2,500 (10.3%)
- Office of the Programme Director $865 (3.6%)
- Administrative Support, Ouagadougou $1,824 (6.7%)
- Liaison AFRO Brazzaville $70 (0.3%)
- Administrative Support, Geneva $178 (0.7%)
- Western extension $1,282 (5.3%)
- Meetings $260 (1.1%)
Annual Transmission Potential

1. Before Programme Operations

2. 1982 - 1983
Prevalence of Onchocerciasis: 0-4 Years

1. Before Programme Operations

2. 1983
Prevalence of Onchocerciasis: 5-9 Years

1. Before Programme Operations

2. 1983
Annex 9

Prevalence of Onchocerciasis: 10-14 Years

1. Before Programme Operations

2. 1983