

# The Agency's activities in the field of nuclear materials

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Since its inception in 1957 the International Atomic Energy Agency has carried out various programmes related to nuclear raw materials. These have covered many aspects of the subject including geological studies through exploration, radiometric measurements and the production of uranium concentrate. Because of mounting world concern over the adequacy of uranium supplies the Agency's activities have grown in the last three years. These activities are of two basic types: General Programmes related to the Division of Nuclear Fuel Cycle; and Technical Assistance to developing Member States.

## General programmes

As far as the general programmes are concerned, the Agency acts as a medium for the interchange of information mainly through organizing scientific meetings and administering research contracts, and by publishing for world circulation the proceedings of these meetings and the results of the research work. The meetings consist of symposia, seminars, technical committees, advisory groups and consultants' meetings.

*Symposia* are normally large meetings which are attended by scientists from Member States as representatives of their Governments. Published proceedings of symposia include such titles as "Uranium in the Pine Creek Geosyncline" (1980), "Uranium Evaluation and Mining Techniques" (1980), "Exploration for Uranium Ore Deposits" (1976), "The Oklo Phenomenon" (1975), "Formation of Uranium Ore Deposits" (1974), "The Recovery of Uranium" (1971), "Nuclear Techniques and Mineral Resources" (1969) and "Radiological Health and Safety in Uranium Mining and Milling" (1964). Symposia may be at the Vienna Headquarters but they may also be organized in developing countries to help provide an element of training by giving national and regional scientists more direct access to the discussions of world experts.

*Advisory group* meetings are composed of small groups of scientists designated by the Director General in their individual capacities as experts to advise him on specific subjects or questions. In recent years, advisory groups convened in Vienna have resulted in publication of "Uranium Deposits in Latin America: Geology and Exploration" (1981), "Evaluation of Uranium Resources" (1979), "Recognition and Evaluation of Uraniferous Areas" (1977), "Uranium Ore Processing" (1975),

"Radon in Uranium Mining" (1973), "Uranium Exploration Methods" (1973), "Uranium Exploration Geology" (1970), and "Processing of Low Grade Uranium Ores" (1966).

*Consultants'* meetings normally consist of three to five, but no more than seven experts in a specific field. They are frequently brought together to discuss and recommend action on specific problems or to assist in writing a report or preparing a manual. For example, the Agency convened a consultants' group to recommend minimum performance specifications for uranium prospecting and evaluation instruments. This resulted in publication of Technical Report No. 158, "Recommended Instrumentation for Uranium and Thorium Exploration" (1974). Another group, convened to recommend reporting methods and calibration in uranium exploration, produced Technical Report No. 174, "Radiometric Reporting Methods and Calibration in Uranium Exploration" (1976). The third publication of this series is "Gamma-ray Surveys in Uranium Exploration" (1979). Additionally, there are two manuals being printed "Application of Remote Sensing to Uranium Exploration" and "Manual on Borehole Logging". In the field of uranium ore processing a technical report entitled "Significance of Minerology in the Development of Flowsheets for Processing Uranium Ores" was published in 1980. Another technical manual "Geochemical Techniques in Uranium Exploration" is under preparation. It should be noted, however, that most consultants' meetings are convened to assist and advise only, and not for the publication of a report.

*Working Groups* are normally convened at technical meetings for the purpose of advising the Agency on specific problem areas. Some working groups meet at regular intervals to review and update information. For instance, one group of experts, jointly sponsored by the IAEA and the Nuclear Energy Agency of the OECD has reviewed the world's uranium resources, production capacity, and demand, at roughly two-yearly intervals since 1965. This biennial report is known as the "Red Book" and is widely accepted as the most authoritative information on uranium resources and production.

Other IAEA/NEA (OECD) Joint Groups are: "Group of Experts on Research and Development in Uranium Exploration Techniques", "Working Party on Uranium Resources" and "Group on Uranium Extraction".

Six working groups on uranium geology were set up as a result of the 1970 Agency Advisory Group and were re-convened in 1972 at the International Geological Congress in Montreal and in August 1976 at the International Geological Congress in Sydney. The proceedings of the Sydney working group were published in 1978 in the IAEA Technical Report series. These groups have met on an ad-hoc basis on the occasion of international uranium geology meetings. The following groups are active at the moment: Sedimentary Basins and Sandstone Type Uranium Deposits; Uranium Deposits in Proterozoic Quartz-Pebble Conglomerates, Vein-Type and Similar Uranium Deposits, Uranium Deposits Related to Magmatic Processes, Surficial Uranium Deposits.

It is interesting to note that Agency publications concerned with uranium resources have enjoyed a total distribution of around 18 000 – among them are several “best sellers”. This number does not include the very wide distribution of the proceedings of the international conferences.

*The research contract* programme is a means of providing direct financial support to research institutes in Member States. The Agency or an institute may propose a particular project for support. In either case, contracts are placed in developing countries whenever possible. Contracts are normally awarded for a period of one year and are renewable up to a total project period of three years. The amounts of the awards are rarely large, averaging not more than US \$6 000 per annum per contract and the contractor is expected to bear part of the cost of the project. Publication of results, either by the research institute or the Agency is normally done at the end of the contract. *Research agreements* are also made with institutes in the more advanced countries and are similar to research contracts except that no financial award is involved. Research contracts and research agreements may be integrated into co-ordinated research programmes in which a number of institutes in both developing and advanced countries co-operate on one specific subject.

In recent years, research programmes on radon and geochemical exploration problems, the recovery of uranium from phosphates, bacterial leaching of uranium ores, continuous extraction of uranium from sea-water have been completed and topics like uranium distribution in ores and source rocks, uranium in alkaline rocks, direct uranium determination in borehole by neutron sources, monitoring of concrete pads used for the calibration of radiometric instrumentation, are being investigated.

Other activities carried out by the Agency include collection and evaluation of all available data on the uranium industry for the benefit of Member States and, as part of this work, two bibliographies, “Geology of Uranium and Thorium”, Vols. I and II (IAEA, 1962 and 1968) have been published. The IAEA is building an

Uranium Resources Information File which will include Reasonably Assured Resources, Estimated Additional Resources, Production and Exploration data on a country-by-country basis, plus current and projected production capacities, a short history of uranium exploration and mining, published uranium sales agreements, production of other mineral products as a measure of the size and sophistication of the total mining industry, and a short geological description.

During 1977–79 the IAEA, in co-operation with NEA, carried out an assessment of the world’s uranium potential. The results of this project called “International Uranium Resources Evaluation Project” (IUREP) were published in 1980 by OECD.

### Technical assistance to developing countries

All Member States are eligible for technical assistance provided under the Agency’s Regular Programme. Both Member and non-Member States are eligible for assistance from the Agency from United Nations Development Programme (UNDP) funds provided that they are economically developing and are members of either the United Nations or one of the UN specialized agencies.

*Technical Assistance* is provided at the request of Member States, but the content of the projects requested may be finalized in consultations with the Agency and, where necessary, the United Nations Development Programme. The kinds of assistance available under these programmes may include expert services, equipment and supplies, UNDP large-scale projects, fellowships and regional projects such as training courses and study tours.

Advisory missions of a few days to a few weeks duration may cover any nuclear energy subject on which a Government wishes advice. These missions are usually carried out by staff from the Secretariat, and frequently their purpose is to discuss programmes and define technical assistance requests.

Individual technical experts or a whole team can be provided at the request of a Government. They are usually recruited for specific assignments, but may be members of the Agency’s staff. Their expertise has covered such subjects as uranium geology, various exploration techniques, ore evaluation, analysis, ore processing and general advisory missions on raw materials policy. On completion of their assignments, experts prepare a report which is transmitted to the recipient Government through the Agency. Reports are initially restricted to recipient Governments but, if requested, may later be made generally available to other Member State Governments.

Equipment and supplies may be furnished in association with the provision of expert services. The equipment provided has mainly consisted of radiometric prospecting and evaluation instruments, analytical equipment, drills and vehicles. During 1981 the following

countries will receive assistance in uranium exploration through the Agency's Regular Programme. Bolivia, Cameroon, Chile, Colombia, Costa Rica, Ecuador, Greece, Madagascar, Malaysia, Mali, Morocco, Pakistan, Portugal, Tunisia, Uruguay, Yugoslavia, Zambia.

*Training fellowships* which are requested by Member State authorities may be awarded as part of a comprehensive project or on an individual basis and are normally for periods of a few months to a maximum of one year. Candidates are selected on the basis of educational and professional qualifications and on the needs of their countries. They are placed in suitable training institutions in host countries who in some cases may also contribute directly to the costs.

It should be noted that among all nuclear fields dealt by the Agency, the largest number of fellowship requests has been uranium exploration. This clearly indicates where in the fuel cycle the main interest of developing countries lies.

The IAEA also acts as Executing Agency in carrying out large-scale UNDP-financed uranium exploration programmes in a number of countries. These programmes are normally of several years' duration, involve a number of experts and fellowship training and are equipped with all necessary material to carry out the project objectives including primary exploration and evaluation of ore deposits. Governments are expected to make a substantial contribution to such projects. Six programmes are presently being implemented: Chile, Peru, Colombia, Madagascar, Lesotho, Greece. In the planning stage there are projects for Ecuador, Costa Rica, and Zambia.

Training courses are normally regional or interregional in character and are usually held in one Member State host country. The Agency, either from its own funds or financed by UNDP, is responsible for general administration and bears a major share of the cost of such items as travel and subsistence for participants, visiting advisors and lecturers and equipment, whereas the host country normally organizes and may provide the greater part of the instructional facilities, internal transport, etc. A regional training course on "Uranium Exploration and Evaluation" was held in Argentina in 1969, an interregional course on "Uranium Ore Analysis" in Spain in 1970, a regional training course on "Uranium Exploration and Evaluation in India" in 1974, an interregional course on "Geochemical Prospecting Methods" in Austria in 1975, and repeated in Yugoslavia in 1977.

### Plans for the future

During 1981 there will be two training courses on "Uranium Exploration Methods", one in Madagascar (June) and another in Bolivia (September). Consultants' meetings are planned to discuss and prepare publications on "Uranium Geology and Tectonic Correlation between the African and South American Continent", "Uranium Extraction Technology", plus continuation of the "Working Groups in Uranium Geology". One field where it is hoped that expansion can take place is in the research contracts, research agreements, and co-ordinated research programmes. The subjects of "Standardization of Radiometric Reporting and Calibration in Uranium Exploration", "Distribution of Uranium in Source Rocks", are being organized and further actions should be initiated.

Co-operation with NEA(OECD) will be expanded through Specialist Steering Group activities on research and development, on "Uranium Exploration Techniques" and on uranium resources including the common standards of reporting uranium resources. At present there are eight r. and d. groups in operation whose work should continue throughout 1981 and 1982. Another group has already finished its work on Case Histories in Uranium Exploration. The other groups are: Uranium Favourability by Mineral Analysis, Gases in Uranium Exploration; Improvements in the Measurement of Natural Gamma Radiation, Borehole Logging in Uranium Exploration, Uranium in Granites, Recognition of Uranium Provinces, Biogeochemical Exploration for Uranium; Non-Radiometric Methods in Uranium Exploration.

By the middle of 1982 most of the above projects should be nearing completion. The results of the large international co-operation effort will be reviewed in a symposium to be held in Paris (OECD-NEA) and planned for 31 May to 3 June 1982. The symposium will be open to all those interested in uranium prospecting techniques, to government departments, and industry concerned with uranium exploration.

An increasing number of requests for uranium exploration projects are being received both for individual expert assistance, equipment donations and also for large-scale projects. It is also expected that the requests for fellowships will increase. In view of the success of the geochemical training course in Austria (1975) and Yugoslavia (1977), it is probable that this type of course will be repeated.