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Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System Including Implementation of Additional Protocols

Report by the Director General

Summary

- This report describes the progress made since the fifty-second regular session of the General Conference in strengthening the effectiveness of the safeguards system and improving its efficiency, including implementation of additional protocols.

Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System Including Implementation of Additional Protocols

Report by the Director General

A. Introduction

1. The General Conference in resolution GC(52)/RES/13, Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System and Application of the Model Additional Protocol¹, requested the Director General to report to the fifty-third regular session on the implementation of the resolution. This report responds to that request and updates the information in last year's report to the General Conference (document GC(52)/13) under this agenda item.

B. The Conclusion and Entry into Force of Safeguards Agreements and Additional Protocols

2. Between 1 July 2008 and 30 June 2009, comprehensive safeguards agreements (CSAs) in connection with the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) entered into force for four States² and additional protocols (APs) for three States³. Two States acceded to the safeguards agreement between the non-nuclear-weapon States of EURATOM, EURATOM and the Agency, and to the protocol additional thereto⁴. An INFCIRC/66/Rev.2-type safeguards agreement was signed and entered into force for one State⁵. During the same period, one State signed a CSA⁶ and five States signed APs⁷. Five States agreed to amend their respective small quantities protocols (SQPs)⁸ in

¹ The text of the Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards is contained in document INFCIRC/540 (Corr.).

² Bahrain, Comoros, Qatar, Saudi Arabia.

³ Colombia, Comoros, United States.

⁴ As a result of Bulgaria's and Latvia's accession to INFCIRC/193, the implementation of safeguards under their respective bilateral CSAs and APs was suspended.

⁵ India.

⁶ Qatar.

⁷ Côte d'Ivoire, India, Iraq, United Arab Emirates, Zambia.

keeping with the Board of Governors' decision of 20 September 2005 regarding SQPs. By the end of June 2009, of the 81 States with operative SQPs⁹, 26 had brought the modified SQP into force.

3. As of 30 June 2009, 167 States had safeguards agreements in force with the Agency, 91 of which (including 86 with CSAs) also had APs in force. Thus, twelve years after the Board of Governors approved the Model Additional Protocol¹⁰ 102 States, including 19 States with significant nuclear activities¹¹, have not yet brought APs into force. With regard to the 72 States which have significant nuclear activities, 62 such States have signed APs, 53 of which have brought APs into force.

4. Twenty-six non-nuclear-weapon States party to the NPT have not yet brought CSAs into force. The latest update of the status of safeguards agreements and APs is published on the IAEA website¹².

B.1. Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols

5. In operative paragraph 24 of resolution GC(52)/RES/13, the General Conference "notes the commendable efforts of some Member States, notably Japan, and the IAEA Secretariat in implementing elements of the plan of action outlined in resolution GC(44)/RES/19 and the Agency's updated plan of action (September 2008), and encourages them to continue these efforts, as appropriate and subject to the availability of resources, and review the progress in this regard, and recommends that the other Member States consider implementing elements of that plan of action, as appropriate, with the aim of facilitating the entry into force of comprehensive safeguards agreements and additional protocols; and the amendment of operative SQPs". Among the elements of the plan of action proposed in GC(44)/RES/19 are:

- Intensified efforts by the Director General to conclude safeguards agreements and APs, especially with those States which have significant nuclear activities;
- Assistance by the Agency and Member States to other States on how to conclude and implement safeguards agreements and APs; and
- Reinforced coordination between Member States and the Secretariat in their efforts to promote the conclusion of safeguards agreements and APs.

The Agency's Plan of Action is published on the IAEA website¹³.

6. Guided by the relevant resolutions of the General Conference and decisions of the Board of Governors, the Agency's updated Plan of Action and the Agency's Medium Term Strategy¹⁴, the Secretariat has continued to encourage and facilitate wider adherence to the strengthened safeguards system, with the assistance primarily of extrabudgetary funds.

⁸ Mauritius, Monaco, Nicaragua, Uganda, United Republic of Tanzania,

⁹ Excluding SQPs to safeguards agreements concluded pursuant to protocols to the Tlatelolco Treaty.

¹⁰ In May 1997.

¹¹ Algeria, Argentina, Belarus, Brazil, DPRK, Egypt, India, Islamic Republic of Iran, Israel, Malaysia, Mexico, Morocco, Pakistan, Philippines, Serbia, Syrian Arab Republic, Thailand, Venezuela, Vietnam.

¹² <http://www.iaea.org/OurWork/SV/index.html>.

¹³ <http://www.iaea.org/OurWork/SV/Safeguards/sv.html>.

¹⁴ Contained in document GOV/2005/8.

7. In order to facilitate the conclusion and implementation of APs, and the implementation of the Board's decision on SQPs, the Secretariat convened two outreach events during the past year: a regional seminar for States in the Greater Caribbean with limited nuclear material and activities, held in Santo Domingo in July 2008; and a briefing on the IAEA's safeguards system, conducted in New York in May 2009 in the margins of the third session of the Preparatory Committee for the 2010 Review Conference of the Parties to the NPT. In addition, consultations on the amendment of SQPs and the conclusion of CSAs and APs were held throughout the year with representatives from Member and non-Member States in Vienna; during the international courses on SSACs held in Mexico in July 2008 for States in Latin America and in the United States in June 2009 for States with SQPs; and during the IAEA seminar on security, safety and safeguards that was conducted in Santo Domingo in February 2009. Overall, the Secretariat held bilateral consultations with over 70 States on the conclusion of safeguards agreements and APs and on the amendment of SQPs.

C. Implementation and Further Development of Safeguards Strengthening and Efficiency Measures

8. The Agency's Safeguards Analytical Laboratory (SAL) in Seibersdorf, which consists of a Nuclear Material Laboratory and a Clean Laboratory, is essential to nuclear material verification and environmental sample analysis. As presented to the Board of Governors in November 2007, the Secretariat has developed a two-phased plan to strengthen the Agency's capability to provide independent and timely analysis of nuclear material and environmental samples. Phase 1 will address the sustainability and enhancement of the Agency's particle analysis capabilities for environmental samples at the Clean Laboratory. Phase 2 will address, in parallel, the future of the Nuclear Material Laboratory. A report on the progress of the project was presented to the Board in November 2008.

9. The estimated overall cost of strengthening the Agency's safeguards analytical capabilities is about € 38 million. For Phase 1, the acquisition and installation of the ultra high sensitivity secondary ion mass spectrometer (UHS-SIMS) for the Clean Laboratory, and the building of a Clean Laboratory Extension to accommodate the UHS-SIMS, would require approximately € 8 million. For Phase 2, the construction of a new Nuclear Material Laboratory, the current financial plan contemplates completion of the conceptual design in 2010 that will be followed by engineering design and construction starting in 2011. The Governments of Japan, the Republic of Korea and Spain have agreed to provide extra-budgetary funding that will partially fund Phase 1 of this project.

10. In addition, the Secretariat is engaged in a long-range strategic planning process. This is to strengthen the existing biennial and medium-term planning processes by supplementing them with a longer range strategic planning framework to further enhance the Agency's ability to conduct its safeguards verification activities effectively and efficiently.

C.1. Drawing Safeguards Conclusions: Further Development of the State Evaluation Process

11. As reported in the Safeguards Statement of the Agency for 2008¹⁵, safeguards were applied during that year for 163 States¹⁶ with safeguards agreements in force with the Agency. The Secretariat's findings and safeguards conclusions for 2008 derive from an evaluation of all the information available to the Agency in exercising its rights and fulfilling its safeguards obligations. The conclusions were reported by type of safeguards agreement and corresponding safeguards obligations.

12. The Secretariat has continued to develop the State-level concept for the implementation and evaluation of safeguards. Under this concept, safeguards implementation and the evaluation of that implementation are based on a State-level approach developed for each State and the annual implementation plan derived therefrom. State-level approaches are developed on a non-discriminatory basis using generic safeguards verification objectives that are common to all States with CSAs. The approaches also take into account State-specific features, such as the characteristics of the State's nuclear fuel cycle and its scientific and industrial infrastructure, thus allowing State-specific technical verification objectives to be developed. As of June 2009, State-level integrated safeguards approaches were being implemented for 42 States¹⁷.

13. In GC(52)/RES/13, the General Conference welcomed efforts to strengthen safeguards, and in this context took note of the Secretariat's activities in verifying and analysing information provided by Member States on nuclear-related supply and procurement in accordance with the Statute and relevant State safeguards agreements, taking into account the need for efficiency, and invited all States to cooperate with the Agency in this regard. In 2008, the Secretariat continued its endeavours with Member States to develop and diversify sources of safeguards relevant information on covert nuclear-related trade. Several States are now either voluntarily providing information on certain nuclear technology-related enquiries and export denials, or are actively considering doing so. The analysis of such information augments the Secretariat's knowledge of covert trade activities and can provide an early indication of undeclared nuclear activities. This analysis complements other safeguards information and is used to support the Agency's verification activities and the State evaluation process.

C.2. Development and Implementation of Safeguards Approaches, Procedures and Techniques

14. Research and development (R&D) in safeguards approaches, procedures and techniques, carried out with the assistance of Member State Support Programmes (MSSPs), is essential to meeting the safeguards challenges of the future. Assistance from MSSPs has been crucial because the Secretariat lacks its own R&D capabilities. The needs of the Agency in this regard are communicated to the MSSPs through a biennial R&D Programme for Nuclear Verification. The R&D Programme for Nuclear Verification 2008–2009 reflects high priority needs for further enhancement of efficiency and

¹⁵ The Safeguards Statement for 2008 and the Background to the Safeguards Statement and Summary of the Safeguards Implementation Report for 2008 are published on the IAEA website at <http://www.iaea.org/OurWork/SV/Safeguards/es2008.html>.

¹⁶ And Taiwan, China.

¹⁷ See paragraph 36.

effectiveness of safeguards activities. As of 30 June 2009, there were 21 MSSPs¹⁸ conducting over 300 tasks valued at over € 20 million per annum related to such issues as the development of verification technologies and safeguards concepts, information processing and analysis, and training. Attended by experts from Member States, the Agency has organized a number of R&D meetings and workshops, most notably on: (i) laser induced breakdown spectroscopy for safeguards applications; (ii) future use of antineutrino detection and monitoring; and (iii) implementation of tuneable diode laser spectrometry for safeguards. These technical meetings continue to provide essential input to the Agency's R&D programme.

15. The Secretariat has continued its efforts to identify and develop effective advanced technologies for the detection of undeclared nuclear material and activities. Two tasks in the area of novel technology, i.e. laser induced breakdown spectroscopy and optical stimulated luminescence for safeguards applications, are expected to deliver prototypes by early 2010. A study was also initiated on modelling signatures of gases released from nuclear fuel cycle processes.

C.2.1. Safeguards Approaches

16. The Secretariat has continued to develop and implement more efficient approaches for verification of spent fuel transfers. This includes approaches involving unattended monitoring and surveillance systems; and approaches based on verification through short notice and unannounced inspections of States' declarations to a "mailbox" system of facilities' operational plans and data.

17. A draft safeguards approach based primarily on the use of random inspections (with short notice to the State) supported by unattended non-destructive assay (NDA) and containment/surveillance (C/S) measures has been developed for the JMOX plant in Japan where construction has not yet commenced. This approach is designed to ensure effective safeguards while achieving greater efficiency than an approach based solely on scheduled inspections. The conceptual design of the three most important safeguards systems to be used at the facility was completed in 2008. The development of equipment for the JMOX plant uses an approach based on lessons learned from the Rokkasho Reprocessing Plant, including provision for an integrated data acquisition system. The JMOX project also serves as an engineering template for the modernization of unattended monitoring systems.

18. At Chernobyl, the conditioning for long-term dry storage of irradiated fuel from reactor units 1 and 3 and from the wet storage facility has been delayed until at least 2013, since a significant redesign and modification of the new conditioning facility needs to be undertaken. This will affect the Agency's safeguards approach and systems at this facility, which will need to be modified and upgraded, and for which additional equipment will need to be acquired.

C.2.2. Information Technology

19. The Agency has continued to work on the IAEA Safeguards Information System (ISIS) Re-engineering Project (IRP). The objective of the IRP is to increase the effectiveness and efficiency of information processing by replacing the current information environment with a modern, integrated information system. As reported in last year's report to the General Conference, Phase I (Solution Design) and Phase II (Foundation) have been completed. Progress has been made in the Phase III (Implementation) projects to implement the re-engineered and custom-developed applications. Phase III, made up of 16 projects, was revised to take into consideration all of the Department of Safeguards' information needs to ensure the integration and consistency of the overall IRP. Six of the projects were

¹⁸Argentina, Australia, Belgium, Brazil, Canada, China, Czech Republic, European Commission, Finland, France, Germany, Hungary, Japan, Netherlands, Republic of Korea, Russian Federation, South Africa, Spain, Sweden, United Kingdom and the United States of America.

completed in 2008; procurement bids were initiated for the remaining 10 projects. In addition, work began on a centralized security solution supporting all business needs. Implementation of these projects will start in late 2009 with the goal to complete the overall IRP project in 2011.

20. The Department of Safeguards continues to exploit high resolution commercial satellite-based sensors to improve its ability to monitor nuclear sites and facilities worldwide. Imagery was acquired using 16 different Earth observation satellites owned by 11 imagery providers in 8 States. High resolution radar data was used to provide day/night and all-weather monitoring opportunities. In addition, new operational Earth observation satellites were used to further diversify the Agency's sources to ensure integrity and authenticity of satellite imagery. During the past year, 411 commercial high resolution satellite images were acquired, including 22 high resolution radar scenes, and 102 analytical products (which included imagery and geospatial analysis reports, site maps, and posters) were prepared by the Department of Safeguards.

C.2.3. Safeguards Equipment

21. Since last year's report to the General Conference (GC(52)/13), the development and implementation of new safeguards verification systems continued in many areas, including technical support and development activities for fresh mixed oxide (MOX) fuel and spent fuel verification, and the development and upgrading of safeguards instruments and methods for centrifuge enrichment plants.

22. At the end of June 2009, the Agency had 1122 cameras connected to 599 systems operating at 245 facilities in 33 States¹⁹. There were 120 unattended monitoring systems installed in 27 facilities in 21 States. In addition, remote monitoring systems continued to be installed or upgraded: 187 surveillance or radiation monitoring systems with remote transmission capabilities were authorized for inspection use in 16 States²⁰ (110 surveillance systems with 389 cameras and 77 unattended radiation monitoring systems). Of these, 166 systems in 16 States²¹ were capable of transmitting all data required for safeguards purposes. Remote monitoring has become an integral part of many safeguards approaches and has resulted in enhanced effectiveness and efficiency of safeguards implementation. It is estimated that, in 2008, approximately 200 person days of inspection (PDIs) were saved due to remote monitoring.

23. Since last year's report, the Agency made significant progress in the development of new sealing systems and containment verification techniques. In the framework of the metal seal modernization programme, the Department began tests of a laser surface scanner for automatic verification of metal seals and evaluation of a prototype of a wire integrity verification instrument. A new underwater sealing system for CANDU fuel was authorised for inspection use and is successfully replacing the obsolete random coil system. Significant progress was also made in the development of an inexpensive radiofrequency seal for remotely monitored seal arrays.

24. Significant financial and human resources were spent in preventive maintenance and equipment upgrades to ensure and enhance the reliability of the Agency's standard equipment systems. The reliability of digital surveillance systems, unattended monitoring systems and electronic seals have exceeded the target reliability goal of 150 months for the mean time between failures.

¹⁹ See footnote 16.

²⁰ See footnote 16.

²¹ See footnote 16.

C.2.4. Sample Analysis

25. The collection and analysis of nuclear material and environmental samples are essential safeguards measures for detecting diversion of declared nuclear material and presence of undeclared nuclear material and activities. Sample analysis is performed in the Agency's Network of Analytical Laboratories (NWAL), which includes SAL and a number of qualified laboratories in Member States.

26. In 2008, Agency inspectors collected some 750 nuclear material samples and 50 heavy water samples. SAL analyzed some 500 of the nuclear material samples, with supporting measurements performed by other laboratories of the NWAL. The jointly operated IAEA-Japan on-site laboratory at the Rokkasho Reprocessing Plant analyzed about 250 nuclear material samples. Also in 2008, IAEA inspectors collected some 370 environmental samples, 35 of which came from hot cells (which require special handling). From these 370 samples, 660 sub-samples were submitted to the NWAL for analysis.

27. As a result of the Agency's improved management and systematic process monitoring, the average overall time for processing of environmental samples continued to decrease (to 4.1 months in 2008) and is approaching the planned targets (i.e. one month for sample shipping/distribution, one month for analysis of high priority samples or two months for analysis of routine samples, and one month for evaluation of the analytical results). During 2008, the times for shipping of samples from the field and their distribution to the NWAL were shortened and are now close to the target of one month. While the evaluation time has also improved, sample analysis times are still longer than the targets.

28. In order to further improve process performance, the NWAL is being expanded for both nuclear material and environmental sample analysis. At the invitation of the Secretariat, several Member States (Belgium, the Czech Republic, Finland, France, Hungary and the Russian Federation) have indicated their willingness to provide the Agency with support for analysis of nuclear material samples. With respect to environmental sample analysis, laboratories in Brazil, China, Hungary and the Republic of Korea are currently undergoing qualification to enhance the NWAL's capacity for environmental samples.

C.3. Cooperation with State and Regional Systems of Accounting for and Control of Nuclear Material

29. States' systems of accounting for and control of nuclear material (SSACs) are fundamental to effective and efficient safeguards implementation and are required to be established and maintained by all States with CSAs in force. The establishment and effective operation of an SSAC requires a legislative and regulatory framework authorizing, and enabling, the SSAC to exercise the necessary regulatory and control functions. The IAEA SSAC Advisory Service (ISSAS) was initiated in 2005 to provide States with advice and recommendations on the establishment and strengthening of SSACs. As of the end of June 2009, 11 ISSAS missions had been conducted at the request of the Governments concerned. Since last year's report to the General Conference, an ISSAS mission was conducted in Romania. In addition, at the request of Saudi Arabia, an ISSAS mission will be conducted in 2009. In 2008, as part of the follow-up action plan developed for each ISSAS mission, legal assistance and training were provided to, and further consultations conducted with, Armenia, Indonesia, Niger, the Republic of Korea and Switzerland. The progressive implementation of the follow-up action plans has already produced significant improvement in a number of States.

30. Since July 2008, the Agency has conducted ten international, regional and national training courses for States to assist them in fulfilling their obligations under safeguards agreements and APs. These courses included two international SSAC courses in the United States for SQP and non-SQP

States, respectively; five regional SSAC courses (in Mexico, Namibia, Indonesia, Malaysia and Uzbekistan); as follow up to ISSAS missions, two national training courses (in Armenia and Switzerland); and to meet specific national needs, an SSAC training course for Turkmenistan. In support of training organized by Member States, lecture material and instructors were provided for a training course on SSACs organized by the Japanese Atomic Energy Authority in Japan.

31. Cooperation between the Agency, the European Commission and the European Union non-nuclear-weapon States continued in 2008. Agency/Euratom partnership approaches under integrated safeguards were developed for LWRs, spent fuel storage facilities, research reactors and critical assemblies, and depleted, natural and low enriched uranium conversion and fuel fabrication plants, covering over 120 facilities in those States. These approaches include unannounced inspections, short notice random inspections (SNRIs) and mailbox declarations. To facilitate these new approaches, new working arrangements relating to inspection planning and notification were agreed with the European Commission and the relevant States. Cooperation between the Agency and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) has facilitated the implementation of an SNRI scheme at the fuel fabrication plants in Argentina and Brazil and the development of a new safeguards approach for nuclear power plants and transfers of spent fuel bundles to dry storage, including cost-sharing arrangements and the equipment required. Implementation of these approaches will enhance the effectiveness and efficiency of safeguards implementation in the field.

C.4. Training for Agency Staff

32. Since last year's report to the General Conference, 67 major training courses were conducted for Agency safeguards staff, covering basic, refresher and advanced training. These courses included an Introductory Course on Agency Safeguards for newly recruited Agency inspectors, with a comprehensive inspection exercise in Slovakia as part of the final assessment; three AP exercises (in Hungary, Italy and the United States); an NDA training course and a pyro-processing training course in the United States; two proliferation indicators training courses in Vienna; one advanced plutonium measurement training course in Russia; one spent fuel verification training course in Sweden; two advanced training courses on nuclear fuel cycle facilities; and a design information verification course in the United Kingdom. In parallel, training aimed at developing soft skills (observation, communication and writing skills) has also been carried out at the Agency. SAL and facilities made available by Member States are key assets for the implementation of the safeguards training programme.

C.5. Quality Management

33. During the past year, the Department of Safeguards continued to implement its quality management system (QMS). The performance of the QMS was formally reviewed on a regular basis by senior management. As a new feature of the system, all of the key processes within the Department were identified and accountability for the performance of these processes was formally assigned to specific senior staff members within the Department. A new document management system has just been implemented which gives staff a single interface for accessing all management system documents. The internal quality audit programme on departmental processes was operated successfully; non-conformities identified during these audits were entered into the corrective action system for resolution. Staff training to raise awareness of the QMS and to increase the use of the corrective action system, continual process improvement and document control continued to be delivered in the Department and its regional offices.

D. Additional Protocol Implementation and Integrated Safeguards

D.1. Additional Protocol Implementation

34. Additional protocols based on the Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards (INFCIRC/540 (Corr.)) are central to the Agency's ability to detect possible undeclared nuclear material and activities and to draw soundly-based safeguards conclusions with regard to their absence. An AP requires a State to provide the Agency with a wide range of information about its nuclear material, activities and plans, and to provide the Agency with complementary access (CA) to locations in the State. The Secretariat has continued its efforts to implement APs and has invested considerable resources in the analysis, evaluation and follow-up of declarations made under APs. In 2008, 1672 declarations were received from 76 States²² and the European Community and 122 CAs were performed.

35. In addition, to help States meet their obligations, the Agency has held substantive consultations on AP implementation issues with representatives of numerous States. Since July 2008, two regional technical meetings were conducted on AP implementation, one in Kazakhstan with States from the Commonwealth of Independent States, and the other in the Republic of Korea with States from Asia and the Pacific Region.

D.2. Integrated Safeguards

36. The implementation of integrated safeguards offers the best opportunity for increased effectiveness and enhanced efficiency of safeguards. Particularly noteworthy in this regard, yielding both effectiveness and cost-savings, are random inspections (conducted with no notice or short notice to the State), making broader use of appropriate statistical optimization techniques. In GC(52)/RES/13, the General Conference requested the Secretariat to continue to ensure that the transition to integrated safeguards is given high priority. As indicated in paragraph 12 above, the Secretariat has continued to develop further the State-level concept for the implementation and evaluation of safeguards, including through the preparation of annual implementation plans for those States for which the broader conclusion has been drawn. In 2008, integrated safeguards were implemented for the entire year in Australia, Austria, Bangladesh, Bulgaria, Canada, the Czech Republic, Ecuador, Ghana, Greece, the Holy See, Hungary, Indonesia, Ireland, Jamaica, Japan, Latvia, Lithuania, Mali, Norway, Peru, Poland, Portugal, Romania, Slovenia and Uzbekistan. Integrated safeguards implementation has also been initiated in Armenia, Burkina Faso, Chile, Croatia, Cuba, Denmark, Estonia, Finland, Italy, Luxembourg, Madagascar, Malta, Monaco, Palau, the Republic of Korea, Sweden and Uruguay. The Secretariat estimates that the implementation of integrated safeguards in the 25 States²³ where it was implemented during the entire calendar year (excluding the verification effort at the Rokkasho Reprocessing Plant) resulted in savings of approximately 800 person-days of inspection in 2008 – effort which was deployed in other areas.

37. While the figures above show a reduction of inspection effort in the field, there has been a substantial increase in activities at Headquarters related to the introduction of new facilities to safeguards, the evaluation of AP declarations, information analysis (including data now being

²² See footnote 16.

²³ See footnote 16.

transmitted to the Agency remotely) and State evaluations. This reflects the shift in the focus of safeguards implementation to an information driven system that aims at understanding and assessing the consistency of information on a State's nuclear programme as a whole in order to implement safeguards activities in the field and at Headquarters in the most effective and efficient way.