National Report presented by United Mexican States to fulfill the obligations of the Convention on Nuclear Safety 2004-2006

September 2007

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ABBREVIATIONS AND DEFINITIONS

ACI	American Concrete Institute
ADDER	Definitive Radioactive Waste Storage (Almacén Definitivo de Desechos Radiactivos)
ALARA	As Low As Reasonably Achievable
APRM	Average Power Range Monitor
AOO	Anticipated Operational Occurrences
ARTS	Average Power Range Monitor, Rod Block Technical Specification
ASME	American Society of Mechanical Engineers
ASSET	Assessment of Safety Significance Event Team
ASTM	American Society of Testing Materials
ATP	In Plant Temporal Storage (Almacén Temporal en la Planta)
ATS	Temporary Wet Waste On-Site Storage (Almacén Temporal de Desechos Húmedos en el Sitio)
ATWS	Anticipated Transient Without Scram
BOP	Balance of Plant
BRAC	BWR Radiation Level Assessment and Control Points
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owners Group
CAC	Adverse Condition to Quality (Condición Adversa a la Calidad)
CCAC	Re-Used Parts Collecting Center and Contaminated Oil Storage (Centro de Acopio de Partes Reusables y Almacén de Aceites Contaminados)
CENACE	National Center of Energy Control (Centro Nacional de Control de Energía)
CENAPRED	National Center of Prevention of Disasters
CFE	Federal Electricity Commission (Comisión Federal de Electricidad)
CFR	Code of Federal Regulations
CIRO	Independent Operations Review Committee (Comité Independiente de Revisión de Operaciones)
CNA	National Commission of Water (Comisión Nacional del Agua)

CNAC	Non Adverse Quality Conditions (Condiciones No Adversas a la Calidad)
CNSNS	National Commission of Nuclear Safety and Safeguards (Comisión Nacional de Seguridad Nuclear y Salvaguardias)
CONAE	National Commission for Energy Savings (Comisión Nacional para el Ahorro de Energía)
CRD	Control Rod Drive
CRE	Energy Regulatory Commission (Comisión Reguladora de Energía)
CROS	Site Operations Review Committee (Comité de Revisión de Operaciones en el Sitio)
CSN	Convention on Nuclear Safety (Convención sobre Seguridad Nuclear)
DID	Defense in Depth
DDRSS	Dry Solid Radwaste Storage (Depósito de Desecho Radiactivo Sólido Seco)
EAL	Emergency Actions Levels
ECCS	Emergency Core Cooling Systems
EHC	Electro-hydraulic Control System
EOP	Emergency Operation Procedures
ESPEC	Design Specifications (Especificaciones de Diseño)
ETO	Technical Specifications (Especificaciones Técnicas de Operación)
ETOM	Improved Technical Specifications (Especificaciones Técnicas de Operación Mejoradas)
FT	Task Force (Fuerza de Tarea)
GCN	Nuclear Power Plant Division (Gerencia de Centrales Nucleoléctricas) of CFE
GE	General Electric
GERC	Condition Report Evaluation Group (Grupo de Evaluación de Reportes de Condición)
GEV	State Government of Veracruz (Gobierno del Estado de Veracruz)
GSN	Nuclear Safety Division (Gerencia de Seguridad Nuclear) of CNSNS
HIC	High Integrity Containers

IAEA	International Atomic Energy Agency
IEEE	Institute of Electrical and Electronic Engineers
IFIA	Final Environmental Impact Report
IIE	Electric Research Institute (Instituto de Investigaciones Eléctricas)
INES	International Nuclear Event Scale
INEN	National Institute for Nuclear Energy
ININ	National Nuclear Research Institute (Instituto Nacional de Investigaciones Nucleares)
INPO	Institute of Nuclear Power Operations
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination for External Events
IRRT	International Regulatory Review Team
IRS	Incident Reporting System
ISSE	Safety Analysis Report, Second Stage (same as Final Safety Analysis Report, FSAR)
ISO	International Organization for Standardization
JIT	Just In Time
Km	Kilometers
KV	Kilovolts
LER	Licensee Event Report
LERF	Large Early Release Frequency
LOCA	Loss of Coolant Accident
LPCI	Low Pressure Core Injection
LPCS	Low Pressure Core Spray
LRS	Liquid Radwaste System
LVNPS	Laguna Verde Nuclear Power Station (same as Central Nucleoeléctrica Laguna Verde, CLV)
MEOD	Maximum Extended Operation Domain
MVA	Megavolts Ampere
MWe	Electrical Megawatts
MWt	Thermal Megawatts
NAE	Emergency Action Levels (Niveles de Acción de Emergencia)
NEA	Nuclear Energy Agency

NEI	Nuclear Energy Institute
NER	Notification of Reportable Event (Notificación de Evento Reportable)
NOM	Mexican Official Standard (Norma Oficial Mexicana)
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NUPIC	Nuclear Procurement Issues Committe
OBE	Operating Basis Earthquake
ODCM	Off-site Dose Calculation Manual
OECD	Organization for Economic Co-Operation and Development
OPRM	Oscillation Power Range Monitor
OSART	Operational Safety Assessment Review Team
PAC	Corrective Action Program (Programa de Acción Correctiva)
PCP	Process Control Program (Programa de Control de Proceso)
PCPA	Set Point Change Package (Paquete de Cambio de Punto de Ajuste)
PE	Emergency Procedures
PEI	Internal Emergency Plan (Plan de Emergencia Interna)
PEIR	Preliminary Environmental Impact Report
PERC	Component Replacement Evaluation Package (Paquete de Evaluación de Reemplazo de Componente)
PERE	External Radiological Emergency Plan (Plan de Emergencia Radiológico Externo)
PFP	Preventive Federal Police (Policía Federal Preventiva)
PGCO	Quality Assurance Plan for Operation (Plan de Garantía de Calidad de Operación)
PI	Performance Indicator
PEMEX	Mexican Petroleum Company (Petróleos Mexicanos)
PM	Modification Package (Paquete de Modificación)
PMDT	Technical Documentary Modification Package (Paquete de Modificación Documental Técnica)
PMM	Minor Modification Package (Paquete de Modificación Menor)
PMMD	Minor Documentary Modification Package (Paquete de Modificación Menor Documental)

PMRC	Component Replacement Modification Package (Paquete de Modificación por Reemplazo de Componente)
PMS	Software Modification Package (Paquete de Modificación de Software)
PROC	Procedures (Procedimientos)
PROFEPA	Environmental Protection Agency (Procuraduría Federal de Protección al Ambiente)
PSA	Probabilistic Safety Analysis
PSAR	Preliminary Safety Análisis Report
PTN	Nominal Thermal Power (Potencia Térmica Nominal)
PyD	Jumper and Disconnection (Puente y Desconexión)
QA	Quality Assurance
RAW	Risk Achievement Worth
RCIC	Reactor Core Isolation Cooling System
REI	Internal Event Report (Reporte de Evento Interno)
RDDCC	General Control Room Design Review Plan (Plan General de Revisión del Diseño del Cuarto de Control)
RHR	Residual Heat Removal System
Ro	Outage for Fuel Reloading
ROP	Reactor Oversight Process
RPV	Reactor Pressure Vessel
RRC	Reactor Recirculation Core System
RRW	Risk Reduction Worth
RTP	Rated Thermal Power
RWCU	Reactor Water Cleanup System
SBO	Station Blackout
SAT	Systematic Approach to Training
SCRAM	Sudden Control Rod Action Movement
SCT	Department of Communications and Transportation (Secretaría de Comunicaciones y Transportes)
SGTS	Standby Gas Treatment System
SENER	Department of Energy
SEDENA	Department of Defense (Secretaría de la Defensa Nacional)

SEGOB	Department of the Interior (Secretaría de Gobernación)
SIIP	Process Information Integral System (Sistema Integral de Información de Proceso)
SM-AM	Department of the Navy (Secretaría de Marina y Armada de México)
SMT	Temporary Modification Request (Solicitud de Modificación Temporal)
SPDS	Safety Parameter Display System
SRLR	Supplemental Reload Licensing Report
SRNM	Startup Range Neutron Monitor
SRM	Source Range Monitor
SRO	Senior Reactor Operator
SS	Department of Health (Secretaría de Salud)
SSE	Safe Shutdown Earthquake
ST	System Test
Sv	Sievert
TEDE	Total Effective Dosis Equivalent
TMVB	Trans-Mexican Volcanic Belt
TNP	Treaty on the non-Proliferation of Nuclear Weapons
TÜV	TÜV ANLAGENTECHNIK GMBH
U	Unit
UIIS	Independent Safety Engineering Unit (Unidad Independiente de Ingeniería de Seguridad)
USA	United States of America
USNRC	United States Nuclear Regulatory Commission
USQ	Unreviewed Safety Question
UST	Universal Transverse Mercator
VARIOS	Miscellaneous Documents (Varios)
VCD	Volts Direct Current Power
VS	Balance of Plant System Test
WANO	World Association of Nuclear Operators
WANO AC	World Association of Nuclear Operators Atlanta Centre

INTRODUCTION

PREPARATION AND SCOPE OF THE NATIONAL REPORT

National policy

The national policy, regarding nuclear activities, is contained in Article 27 of the Regulatory Law on Nuclear Matters, and its main objective is that nuclear energy may only be used for pacific purposes, and nuclear, radiation, and physical safety shall be of utmost importance in all nuclear energy activities, and this shall prevail in all nuclear installation stages: siting, design, construction, tests, operation, modification, definite closure and dismantling.

Nuclear Program in Mexico

The Federal Electricity Commission (CFE) does not foresee the construction of a new nuclear installation for generating electric power in the next few years.

Recently, the Federal Electricity Commission (CFE) has signed a contract to increase the power of two Laguna Verde Nuclear Power Station units to 120% (2317 MWt) of the originally licensed power (1931 MWt). It is currently at 105% of the original (2027 MWt). CFE is forecasting that this power increase will be complete in 2010 for both units.

National Report

Pursuant Article 5 of the Convention on Nuclear Safety, this document summarizes the actions taken in the period from January 1, 2004 to December 31, 2006, in relation to the only existent nuclear installation in Mexico (for purposes of the Convention): Laguna Verde Nuclear Power Station (LVNPS) with its two units. Annex I includes a description of the plant with some of its main characteristics.

This report is organized following the structure of the 19 articles of the Convention and includes in Annex II the information that remains unchanged in the period to be reported and that was contained in the original report, as well as its 1st and 2nd revision.

The Report was prepared by instruction from the Department of Energy (SENER) by the National Commission of Nuclear Safety and Safeguards (CNSNS), Mexican Regulatory Body in this matter, acting as general coordinator, and by the Nuclear Power Plant Division (GCN) of the Federal Electricity Commission. The latter is responsible for the safe operation of Laguna Verde Nuclear Power Station.

With this document and the attachments which form an integral part of it, the Mexican Government fully recognizes its commitment to continue applying all fundamental principles of nuclear, radiation and physical safety to Mexican nuclear installations, to maintain and increase their safety level.

In this document, the description of the safety evaluations carried out in all stages of LVNPS, both by internal as well as external organizations, is included. These do not state the existence of an adverse condition for safe operation, therefore, in the opinion of the Mexican State, it can be concluded that the main commitments of the Convention on Nuclear Safety continue to be satisfied.

Information to the public

This National Report, the previous ones corresponding to the 1st, 2nd and 3rd Review Meeting of the Convention on Nuclear Safety, as well as the questions and answers by the Contracting Parties, are public documents that comply with the current Mexican Law, denominated “Federal Transparency and Government Public Information Access Law”, which became effective on June 12, 2002, as well as the recommendations of the Convention, contained in document INFCIRC/572/Rev. September 2, 2002.

ARTICLE 6. EXISTING NUCLEAR INSTALLATIONS

6.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

6.2 NUCLEAR INSTALLATIONS IN THE UNITED MEXICAN STATES

For the purposes of the Convention on Nuclear Safety, there is one nuclear installation in Mexico: the Laguna Verde Nuclear Power Station (LVNPS) with two Boiling Water Reactor (BWR) units and a gross electric power of 682.44 MWe each.

This installation is located in the State of Veracruz, on the coast of the Gulf of Mexico, 75 kilometers to the north of Veracruz City.

The main characteristics of Laguna Verde Nuclear Power Station Units 1 and 2 are described in Annex I. This nuclear installation was originally presented in the past National Reports (Annex II) to satisfy the commitments of the Convention on Nuclear Safety. During 2004-2006 covered by this National Report no new nuclear facilities are reported in addition to the above mentioned.

6.3 MAIN ACTIVITIES CARRIED OUT TO ENHANCE SAFETY IN THE PERIOD FROM 1998 TO 2006

Since 1998 the LVNPS has implemented a program to deal with and resolve the most relevant safety issues; this program is effective from 1998 to 2006 and pursues five objectives: Safety, Environment, Generation, Human Resources and Costs. The Nuclear Power Plant Division (GCN) has declared the enhancement of Nuclear Safety as the most important of these objectives. The topics covered by this program are the following:

1. Collective dose reduction (in process, see Article 15 of this National Report).
2. Intergranular stress corrosion cracking control (in progress, see Article 19 of this National Report).

3. Replacement of Emergency Core Cooling Systems (ECCS) suction strainers to avoid plugging (implemented).
4. Improvement of reactor pressure vessel instrumentation to avoid degasification problem during reactor pressure vessel depressurization (implemented).
5. Installation of an automatic detection and suppression system for core instabilities (in process).
6. Low Voltage Second Level Protection (implemented).
7. Replacement of improved isolation valves for the discharge in the Reactor Recirculation Core System, RRC (implemented).
8. Modernization of the LVNPS full-scope simulator. The simulator has 104 advanced modules, a new computer platform and new communication interfaces (in operation since August 2005).
9. Conversion to Improved Technical Specifications (In process).
10. Implementation of an equipment reliability program (In process).
11. Implementation of an obsolete equipment replacement program (In process).

6.4 FIRST REVIEW MEETING COMMITMENTS

Table 6.1 shows the state of resolution to recommendations that arose during the First Review Meeting of the Contracting Parties held in Vienna, Austria in 1999.

6.5 SECOND REVIEW MEETING COMMITMENTS

Table 6.2 shows answers to observations included in Annex V of the IAEA document CNS-RM-2002/02 related to the Second Review Meeting of the Contracting Parties, held in Vienna, Austria, April 15-26, 2002.

Only those observations requiring information from contracting parties were included.

6.6 THIRD REVIEW MEETING COMMITMENTS

Table 6.3 shows answers to observations included in the IAEA document CNS-RM-2005/08 FINAL related to the Third Review Meeting of the Contracting Parties, held in Vienna, Austria, April 11-22, 2005.

Only those observations requiring information from contracting parties were included.

6.7 DIRECTIVES RELATED TO THE NATIONAL REPORTS PRESCRIBED BY THE CSN INFCIRC/572/REV. 2

Table 6.4 shows answers to directives given in the IAEA Document Informative INFCIRC/572/Rev 2 dated September 10, 2002.

6.8 COMPLIANCE WITH DOCUMENTS "UPDATE ON CONTINUITY / NATIONAL REPORT & REVIEW MEETING FORMATS" AND "CNS 2005 RM NATREP/DD REV 02"

Table 6.5 indicates where the recommendations and good practices are treated in this report. The recommendations are from the following IAEA documents; "Convention on Nuclear Safety, Update on Continuity / National Report & Review Meeting Formats (December 2006)" and CNS 2005 RM NATREP/DD, "Convention on Nuclear Safety, National Report Format Discussion Document" of December 2006.

6.9 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

Based on the general description given in this Article and others conforming this National Report, it is shown that laws, regulations and means for the adequate surveillance and supervision by a Regulatory Body independent from utility, are in place in the United Mexican States to satisfy the obligations derived from the Convention on Nuclear Safety. This ensures that operation of the Laguna Verde Nuclear Power Station does not represent any undue risk to public health or safety, nor to the environment.

Regarding specific fulfillment with obligations from the Convention on Nuclear Safety, improvements attained in the period covered by this National Report are described in the subsequent Articles.

It can be concluded from the existing objective evidence summarized in this National Report, that the Laguna Verde Nuclear Power Station meets a comparable level of safety to that of similar plants located in countries with greater nuclear experience. Until now, there are no conditions that could be identified as adverse to safe operation and therefore, there is no plan to shutdown the installation prior to the completion of its lifetime.

Table 6.1 Commitments from the First Review Meeting in 1999

No.	Recommendation	Resolution
1	Independence of Regulatory Body	In the period covered by this National Report there is no progress in achieving the effective independence of the Regulatory Body. However, as it is shown in this National Report, current situation does not compromise the effectiveness and efficiency of the regulatory activities because CNSNS is a semi-autonomous organism of the Mexican government who has enough authority on all the concerns related with nuclear and radiological safety
2	Safety Improvement Programs	Programs and activities carried out by CNSNS and CFE to improve safety are described in the following sections of this National Report: Safety Culture, 10.2 CFE/ GCN Human Resources, 11.2.2 Other actions contributing to prevent human errors and improve man machine interaction, 12.3 The role of the Regulatory Body in reducing events caused by human factor, 12.4 Periodic evaluation of PGCO (Quality Assurance Plan for Operation) adequacy, 13.3.1 of Annex II Regulatory Body activities, 13.4 Safety assessment, Operational stage, 14.2 Safety assessment, actions for its continuous improvement, 14.3 Radioactive waste production- Reduction program, 19.5.5
3	Containment Efficiency	Refer to the section 19.4.1.1 of this National Report
4	Probabilistic Safety Analysis	Consult the following sections of this National Report: Other actions contributing to prevent human errors and improve man machine interaction, 12.3 Probabilistic Safety Analysis (PSA), 14.5
5	Collective Dose and Radiological Effluents	Refer to the section 15.3.1 Radiation Protection Program of this National Report
6	Emergency Preparedness	Refer to the section 16.2.1.1 Emergency Plan Activation Exercises / Drills, of this National Report

Table 6.2 Commitments from the Second Review Meeting in 2002

Observation	Topic	Section of the Report where it is treated
20	In the future reports should provide more information on new legislative frameworks and regulations or the modifications to those existing.	7.4, 15.4.2
23	Some organizations of technical support carry out evaluations on behalf of the Regulatory Body, how is this support obtained without conflict of interests	8.2.1 of Annex II
24	Due to nuclear programs stagnation or reduction, qualified personnel are retiring. Provide information on how the necessary personnel competency and motivation is maintained for the regulation and safe exploitation of the nuclear facilities	8.4, 8.4.1
25	Progress in the independence “de facto” and “de jure” of the Regulatory Body	See point 1 of Table 6.1
26	Pay more attention on improvements in human and financial resources of the Regulatory Body	8.4.1 8.4.2,
27	Provide experience gained on the use of PSA as a support to regulatory activities or inspection, indicators for surveillance of safety. Advantages and limitations of the system used, prescriptive or some less prescriptive	14.2.2.1, 14.5, 14.5.1, 14.5.2, 14.5.3, 14.6.1
31	Provide information on bilateral and multilateral international cooperation among Regulatory Bodies	8.2.1 Annex II
32	Reviews carried out by homologous experts from other countries. International cooperation as a way to share common experiences and exchange information. Maintaining and increasing competency of Regulatory Bodies	8.6 and 8.2.1 Annex II
33	Provide more information on quality management systems in the Regulatory Body	8.5
34	In order to contribute to establish a Regulatory Body with the characteristics of independence, competence and credibility; National Reports, and answers and questions arisen from the Review Meetings should be made public	Introduction
38	Provide more information on those relevant events in nuclear facilities	19.4.1
39	Active management of safety and with a vision of maintaining and improving safety, and improving safety culture. Supervision of the quality of safety management and the safety culture	10.2
40	Improvements on the containment safety, capacity and stagnancy	19.4.1.1
42	Details and actual experience on the management of severe accidents and the improvement of the containment to deal with this type of accidents	14.5.2

Observation	Topic	Section of the Report where it is treated
44	Situation of programs for safety improvement	See point 2 of the Table 6.1
50	Information on the use of Probabilistic Safety Analysis	14.5, 14.5.1, 14.5.2, 14.5.3
57	Updating of the evolution of the trends in occupational doses and emissions to the environment, and on real time exchange of surveillance data	15.3.1, 15.3.2
61	Improvements to emergency preparedness, including the results of national and international exercises / drills	16.5.1, 16.2.2, 16.3.3 of Annex II

Table 6.3 Commitments from the Third Review Meeting in 2005

Observation	Topic	Section of the Report where it is treated
3	Knowledge management, retirement of experienced and executive personnel in the industry and Regulatory Body	8.4, 8.4.1, 1.2.2, 12.5.3
4, 32	Programs on plant aging management, maintenance and motivating the labor force to maintain safety, implementation of the Systematic Approach to Training (SAT)	11.3.2.1, 10.2, 19.6
29	Effective independence of the Regulatory Bodies is an essential element in nuclear safety. Regulatory Bodies of many Contracting Parties act with a “de facto” independence, relying on strongly established management policies; nevertheless, it is desirable to enhance “de jure” independence	See Point 1 on Table 6.1
44	Contracting Parties ensure that operation organizations commit to self-evaluations and to safety management processes. Safety culture tools and safety management systems.	10.2, 12.2
47	Improvements in methodologies to analyze events where human factors are present	12.2
53	How expedite communication to possibly affected towns and countries in emergencies	16.3, 16.3 of Annex II
54	Implementation of all ICRP 60 recommendations	15.4.1
60	Experience in the implementation of risk-informed decisions	14.5.3
65	Experience with Probabilistic Safety Analysis	14.5, 14.5.1, 14.5.2
75	Advances in operational experience feedback	19.4.1, 19.4.2
76	More information on the development and implementation of programs for severe accident management	14.5.2
78	Greater and detailed information on the status of programs for safety enhancement	6.3, 14.3

Table 6.4 Directives Related to the National Reports Prescribed by the CSN INFCIRC/572/REV. 2

Comment	Recommendation	Section of the Report where it is treated
Introduction	National policy on nuclear safety activities, description of nuclear programs, and general exposition of safety concerns	Introduction
Introduction	List of the nuclear facilities in service	Annex I
6	List of existent nuclear facilities	Annex I
6	List of facilities where corrective actions are considered, according to Articles 10 to 19	6.9
6	Description of safety assessments and results	14.2, 14.3
6	Description of programs and actions taken for safety improvement	See point 2 of the Table 6.1, 14.3
6	Position of the contracting party to continue the exploitation of the nuclear installation	6.9
7	Description of the national legislative and regulatory framework	7 and 7 of Annex II
7	Summary of laws, regulations and requirements of the licensing process, inspection and evaluation; as well as the procedure to assure the fulfillment of the regulations for safety	7 and 7 of Annex II
8	Description of mandate and functions of Regulatory Body	8.3 and 8.1 of Annex II
8	Basic document which establishes the authority and responsibilities of Regulator Body	8.2, 8.3
8	Organization and structure of the Regulatory Body	8.3
8	Position of the Regulatory Body in the government structure	8.3
8	Relation of the Regulatory Body with the organizations in charge of the development and the use of the nuclear energy	8.2.1 of Annex II
9	Description of the main responsibilities of the holder of a license	9.2 of Annex II
9	Description of means used by the Regulatory Body to make sure that the licensee assumes his prime responsibility on safety	9.3 of Annex II
10	Principles that emphasize the absolute priority of safety. Principles of priority of the safety relative to the Regulatory Body, designers, constructors, operators and the holder of the license, as well as relative to: Safety policy, safety culture, commitments to attain safety, regulatory control, activities and voluntary good practices	10.2 and 10.1 and 10.2 of Annex II
11	Financial and human resources of licensee/applicant available to provide support to the nuclear installation during its lifetime	11.2.2 and, 11.2.3 and 11.1.2 of Annex II

Comment	Recommendation	Section of the Report where it is treated
11	Financing for safety improvements made to nuclear installation during their operation	11.1 of Annex II
11	Financial and human resource provisions for the final closure and management of radioactive waste	11.4
11	Norms, regulations and resources for the qualification, training, re-training of personnel , including training in simulators in all the activities related to safety for each installation	11.1, 11.1.2 of Annex II
12	Methods to prevent, detect and correct the human errors, including the analysis of errors, man-machine interface, operational aspects and feedback of experience	12.3
12	Management and organizational issues	12.3
12	Roles of the Regulatory Body and licensee regarding professional performance issues	12.4
13	Quality Assurance Policy	13.1 of Annex II
13	Quality Assurance programs related to all the aspects of the safety during the lifetime of the nuclear installation	13.2, 13.3 and 13.2 and 13.3 of Annex II
13	Methods used in the application and evaluation of Quality Assurance programs	13.3.1, of Annex II
13	Regulatory control activities	13.4
14	Licensing procedure, safety analysis reports in the different stages of projects related to a nuclear installation	7.4, of Annex II and 14.3
14	Summary of essential generic results of permanent observation and periodic safety reviews of the nuclear facilities using deterministic and probabilistic analysis methods, as applicable	14.2, 14.3, 14.5
14	Verification programs (preventive maintenance, in-service inspection of main components, evaluation of aging processes, etc.)	14.2.2.1, 19.6 and 14.3.2.1 B) of Annex II
14	Regulatory control activities	14.2.2.1, 14.3.2.1 of Annex II
15	Summary of laws, regulations and requirements on radiation protection applied to nuclear facilities	15.2 and 7.4
15	Application of the laws, regulations and national requirements related to the radiation protection, including data on: dose limits, fulfillment with the requirements for emission of radioactive material, measures adopted to guarantee that exposures are maintained ALARA, environmental radiological surveillance, activities of regulatory control	15 and 15 of Annex II
16	Outline of laws, regulations and requirements related to the preparation for on site and off site emergencies	16.1.1 of Annex II
16	Provisions for emergency preparedness, including the role of the Regulatory Body and other organizations, emergency classification,	16 and 16 of Annex II

Comment	Recommendation	Section of the Report where it is treated
	national general emergency plan, on site and off site nuclear emergency plans, including supporting organizations and systems, means to inform the public about the emergency preparedness in the vicinities of the nuclear installation	
16	Training and exercises / drills	16.2, 16.1.5 of Annex II
16	International Agreements, including those with neighboring countries, as adequate	16.3 of Annex II
17	Description of licensing procedure, including a summary of the laws, regulations and national requirements for nuclear installations sitting , evaluation criteria for site factors that influence safety, evaluation criteria for environmental and local population impact of the nuclear installation	7.4, and 17.1 of Annex II
17	Requirements for the application of the mentioned criteria	17.1 of Annex II
17	Activities oriented to maintain the acceptability of the nuclear installation safety, taking into account site dependent factors	17.1 of Annex II
17	International agreements, including those with neighboring countries, as necessary	16.3 of Annex II
18	Description of licensing procedure, including a summary of laws, regulations and national requirements for the design and construction of nuclear facilities	7.4, and 18.1 of Annex II
18	Application of the concept “Defense in Depth” according to the principle of the existence of several protection levels, in particular the integrity of barriers, considering internal and external events	18.3 of Annex II
18	Accident prevention and mitigation	18.3 and 18.4 of Annex II
18	Provisions for the adoption of proven technologies by experience or verified by tests or analysis	18.5 of Annex II
18	Requirements for a reliable, stable and controllable operation, with special consideration to human factors and man-machine interaction	12.3, 18.1 of Annex II
19	Description of licensing procedure, including a summary of the laws, regulations and national requirements related to the exploitation of nuclear facilities	7.4, and 19.1 of Annex II
19	Description of the measures adopted by the Contracting Party to satisfy the obligations derived from Article 19 of the Convention	19 and 19 of Annex II
From 7 to 19	Achievements and changes in safety related activities since the previous National Report	10.3.1, 11.5.1, 12.5.1, 13.5.1, 14.6.1, 15.4.1, 16.5.1, 19.8.1
From 7 to 19	Future safety related activities and programs for the period to be covered by the next National Report	10.3.2, 11.5.2, 12.5.2, 13.5.2, 14.6.2, 15.4.2, 16.5.2, 19.8.2

Comment	Recommendation	Section of the Report where it is treated
From 7 to 19	Safety concerns and foreseen actions	10.3.3, 11.5.3, 12.5.3, 13.5.3, 14.6.3, 16.5.3, 19.8.3

Table 6.5 Fulfillment with documents "Update on Continuity / National Report & Review Meeting Formats" and "CNS 2005 RM NATREP/DD Rev 02"

Directive or Good Practice	Section of the Report where it is treated
Report on the status of attention to observations of Summary Reports of the previous Review Meetings, as applicable	6.4, 6.5, 6.6
Identify commitment actions to enhance safety, derived from comments and suggestions from the previous Review Meetings to National Reports	6.3, 6.4, 6.5, 6.6
Identify and discuss the main national activities related to Convention obligations, particularly with the evaluation of safety, inspection and enforcement.	7.3, 14
Describe how the national decisions were reached, with an aggregated value to original decisions	The Report text includes it
Reproduce the text of the same article of the Convention at the beginning of each article	6.1, 7.1, 8.1, 9.1, 10.1, 11.1, 12.1, 13.1, 14.1, 15.1, 16.1, 17.1, 18.1, 19.1
Structure the National Report text according to each sub article and sub subject of each Convention article	The Report text includes it
Include a detailed table of contents, incorporating the page numbers of the documents sequentially	Index
List abbreviations used in the National Report	Definitions and Abbreviations

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK

7.1 OBLIGATIONS

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.

2. The legislative and regulatory framework shall provide for:

i) the establishment of applicable national safety requirements and regulations;

ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence:

iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;

iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

7.2 LICENSING PROCESS

The licensing process for nuclear installations has not changed. The CNSNS carries out the Safety Analysis Report evaluation presented by the applicant and recommends to the Department of Energy the granting or denial of permits or licenses required during the lifetime of the nuclear installation (Annex II).

7.3 ASSURANCE OF COMPLIANCE WITH SUSPENSION, MODIFICATION AND REVOCATION MEASURES

Concerning the assurance of compliance with suspension, modification and revocation measures has not changed. However, in order to enhance and make more transparent and effective the enforcement system, the CNSNS has finished a first version of its Policy on the Application of Enforcement and Administrative Sanctions to National Nuclear Installations, which shall be reviewed by the Nuclear Safety Division and by the departments that are part of it, as well as by the Department of Legal and International Affairs, and then by licensees. The goal is to implement this policy before the end of 2007.

Procedures to implement the policy shall be developed during 2007. Both the policy as well as the procedures emphasize the compliance with regulatory requirements and promote detection by the licensee of any non compliance.

7.4 LAWS, REGULATIONS AND REQUIREMENTS RELATED TO NUCLEAR SAFETY

As explained in previous National Reports (Annex II), the current regulatory framework in Mexico for nuclear installations corresponds to the country of origin of the reactor, which in this case is the USA. The adoption of their regulation includes risk informed and regulation based performance.

Regarding Mexican regulations in 2004-2006 period, the NOM-002-NUCL-1994 “Leak and air tightness tests of sealed sources” was reviewed. It was replaced by NOM-002-NUCL-2004 with the same title. This change was done in accordance with Norm ISO-9978-1992 “Radiation Protection – Sealed Radioactive Sources – Leakage Test methods” to include radioactive methods.

Table 7.1 provides a general summary of Official Mexican Standards applicable to national nuclear installations. Table 7.2 includes some industrial safety standards used in the LVNPS, however, these are outside the competency sphere of CNSNS.

7.5 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

The United Mexican States have a legislative and regulatory framework that adequately regulates safety of nuclear installations on national territory. So it may be concluded that obligations of Article 7 of CSN are met.

Table 7.1 Summary of Mexican Official Standards Applicable to Nuclear Facilities

Standard	Title	Publication date
NOM-001-NUCL-1994	DOSE EQUIVALENT CALCULATION FACTORS	Feb-6, 1996
NOM-002-NUCL-1994 (replaced by NOM-002-NUCL-2004)	LEAK AND TIGHTNESS TESTS FOR SEALED SOURCES	Sep-2-2004
NOM-004-NUCL-1994	CLASSIFICATION OF RADIOACTIVE WASTE	Mar-4, 1996
NOM-005-NUCL-1994	ANNUAL RADIONUCLIDE INCORPORATION LIMITS (LAI) AND DERIVED CONCENTRATIONS IN AIR (CDA) FOR OCCUPATIONALLY EXPOSED PERSONNEL	Feb-16, 1996
NOM-006-NUCL-1994	CRITERIA FOR THE APPLICATION OF ANNUAL INCORPORATION LIMITS FOR CRITICAL PUBLIC GROUPS	Feb-20, 1996
NOM-008-NUCL-2003 Version 1994. Canceled	RADIOACTIVE CONTAMINATION CONTROL	Dec-29, 2003
NOM-012-NUCL-2002 Version 1995. Canceled	REQUIREMENTS AND CALIBRATION OF IONISING RADIATION MONITORS	Jun-19, 2002
NOM-018-NUCL-1995	METHODS TO DETERMINE ACTIVITY CONCENTRATION AND TOTAL ACTIVITY IN RADIOACTIVE WASTE PACKAGES	Aug-12, 1996
NOM-019-NUCL-1995	REQUIREMENTS FOR LOW LEVEL RADIOACTIVE WASTE PACKAGES FOR THEIR DEFINITIVE STORAGE NEAR THE SURFACE	Aug-14, 1996
NOM-021-NUCL-1996	LIXIVIATION TESTS FOR SOLIDIFIED RADIOACTIVE WASTE SPECIMENS	Aug-4, 1997
NOM-024-NUCL-1995	REQUIREMENTS AND CALIBRATION OF DIRECT READING DOSIMETERS	Aug-5, 1997
NOM-026-NUCL-1999	MEDICAL SURVEILLANCE FROM OCCUPATIONALLY EXPOSED PERSONAL TO IONISING RADIATION	Jul-5, 1999
NOM-028-NUCL-1996	RADIOACTIVE WASTE HANDLING IN RADIOACTIVE FACILITIES THAT USE OPEN SOURCES	Dec-22, 1998
NOM-031-NUCL-1999	REQUIREMENTS FOR THE QUALIFICATION AND TRAINING OF THE OCCUPATIONALLY EXPOSED PERSONAL TO IONISING RADIATIONS	Dec-28, 1999
NOM-034-NUCL-2000	SELECTION, QUALIFICATION AND TRAINING REQUIREMENTS OF PERSONNEL IN NUCLEAR POWER PLANTS	Sep-4, 2000

NOM-035-NUCL-2000	LIMITS FOR CONSIDERING A SOLID RESIDUE AS RADIOACTIVE WASTE	May-19, 2000
NOM-036-NUCL-2001	REQUIREMENTS FOR FACILITIES FOR TREATMENT AND CONDITIONING OF RADIOACTIVE WASTE	Sep-26, 2001

Table 7.2 Summary of Official Mexican Standards Applicable to Nuclear Facilities that are not in the competency sphere of CNSNS

Norm	Title
NOM-005-STPS-1998	SECURITY AND HYGIENE CONDITIONS IN LABOR CENTERS FOR THE HANDLING, TRANSPORTATION AND STORAGE OF DANGEROUS CHEMICAL SUBSTANCES
NOM-012- STPS-1999	RELATIVE TO HYGIENE AND SAFETY CONDITIONS IN LABOR CENTERS WHERE IONISING RADIATION SOURCES ARE PRODUCED, USED, HANDLED, STORED OR TRANSPORTED
NOM-017- STPS-2001	RELATED PERSONAL PROTECTION EQUIPMENT FOR WORKERS IN LABOR CENTERS
NOM-002- STPS-1993	RELATED SECURITY AND HYGIENE CONDITIONS FOR THE PREVENTION AND PROTECTION AGAINST FIRE IN THE LABOR CENTERS
NOM-010- STPS-1999	SAFETY AND HYGIENE CONDITIONS IN LABOR CENTERS WHERE CHEMICAL SUBSTANCES THAT CAN CREATE CONTAMINATION IN THE LABOR ENVIRONMENT ARE HANDLED, TRANSPORTED, PROCESSED OR STORED
NOM-018- STPS-2000	SYSTEM FOR THE IDENTIFICATION AND COMMUNICATION OF RISKS AND DANGERS DUE TO HAZARDOUS CHEMICAL SUBSTANCES IN LABOR CENTERS
NOM-052- ECOL-1993	CHARACTERISTICS AND LIST OF DANGEROUS WASTES AND THE LIMITS THAT MAKE A WASTE DANGEROUS DUE TO ITS TOXICITY TO THE ENVIRONMENT
NOM-053- ECOL-1993	PROCEDURE TO CARRY OUT THE EXTRACTION TEST TO DETERMINE WHAT CONSTITUTES A DANGEROUS WASTE FOR ITS TOXICITY TO THE ENVIRONMENT
NOM-054- ECOL-1993	PROCEDURE TO DETERMINE THE INCOMPATIBILITY BETWEEN TWO OR MORE WASTES THAT ARE CONSIDERED DANGEROUS BY OFFICIAL MEXICAN NORM NOM-052-ECOL-1993
NOM-133- ECOL-2000	ENVIRONMENTAL PROTECTION, POLYCHLORINATED BIPHENYLS (PCB'S), HANDLING SPECIFICATION

ARTICLE 8. REGULATORY BODY

8.1 OBLIGATIONS

1. *Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.*

2. *Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.*

8.2 ATTRIBUTIONS AND RESPONSIBILITIES

The functions and responsibilities of CNSNS have not changed during the period covered by this report. They are established in the Regulatory Law on Nuclear matters in Article 27 of the Constitution.

The CNSNS has the responsibility to propose and monitor the application of standards and regulations on nuclear and radiological safety, security and safeguards, for the operation of nuclear and radioactive installations, as well as the use, handling, transportation and possession of nuclear and radioactive material.

It is in charge of establishing the basis and preparing of safety evaluation reports for the granting of permits and licenses to nuclear installations by the Department of Energy. In the case of radioactive installations, CNSNS has the discretion to issue the corresponding licenses. It is responsible for carrying out audits, technical visits, inspections and verifications of nuclear and radioactive installations, including aspects of security and safeguards. By law, it has the authority to apply sanctions to those installations that do not comply with the regulatory framework. Regarding licensing of nuclear installation operators, the commission evaluates candidates through written and simulator exams, and issues the corresponding license, when in order.

According to the General Law of Ecological Equilibrium and Environmental Protection, the CNSNS reviews environmental information included in license applications and reviews the periodic reports submitted during operation stage in order to avoid health risks and to ensure the preservation of ecological balance and environmental protection. The Department of Environment and Natural Resources is responsible for the environmental impact evaluation. The Commission conducts an environmental surveillance independent of that of the license holder, through the isotopic analysis of environmental samples that have been collected periodically in the surroundings of the site and processed in the CNSNS laboratory. This program

allows the verification of the consistency of the information presented by the licensee in their periodical reports.

8.3 REGULATORY BODY ORGANIZATION

Figure 8.1 shows how CNSNS fits in the Federal Government, and has not changed during the period covered by this report. The Commission continues reporting to the Department of Energy through the Electricity undersecretary, maintaining its status as a semi-autonomous body of the Department of Energy. The general structure of CNSNS has not changed; however, the need to strengthen some areas of CNSNS has required changes in the organization. The purpose of the changes is to improve the compliance of the Commission with the responsibilities entrusted by law. Figure 8.2 shows the organizational chart of CNSNS. Four Divisions report to the General Director:

Nuclear Safety Division (GSN), monitors the application of standards and procedures related with authorization, licensing, surveillance and procedures of nuclear safety.

Radiation Safety Division, proposes norms in matters of radiation safety and ensuring their application, while maintaining the national system for safeguards and security in nuclear installations and in relation to nuclear and radioactive materials and operates the National Environmental Radiological Surveillance System.

Technology, Regulation and Services Division, updates and adapts the regulatory framework, provides technical support in matters of nuclear and radiological safety, security and safeguards. Also, the division administers information technology and communications.

Finance and Administration Division, administers human, financial and material resources assigned to the Commission, in conformity with the applicable norms and with the established policies. It provides services that are generally required for the maintenance and conservation of installations and property.

The Department of Legal and International Affairs and the CNSNS Organization for Emergency Assistance report directly to the Director.

In 2006, the Regulatory Action Department was created in the Nuclear Safety Division. It is in charge of leading and establishing the evaluation of the impact to safety due to deficiencies detected by inspection of nuclear installations and the evaluation of operational events. This provides the Legal Department with technical arguments for the application of sanctions in case of any regulation violation by the license holder.

Finally, in the Technology, Regulation and Services Division, the Telematics and Information Technology Department was created, with the purpose of strengthening the information technology infrastructure of the Commission.

8.4 HUMAN RESOURCES

Currently, CNSNS has the following active personnel:

	Number
General Management	7
Nuclear Safety Division	33
Radiologic Safety Division	57
Technology, Regulation And Services Division	24
Finance and Administration Division	36
Internal Control Body	5
TOTAL	162

In 2003-2004, 24 positions were canceled since Mexico's Federal Public Administration approved the Program for Early Retirement. The above caused a reduction in the number of personnel at the time.

CNSNS negotiated, with the support of the Department of Energy, the approval of 50 additional positions in the 2005 budget, fifteen of them were aimed to enhance, in a period of approximately two years, the safety evaluation and inspection ability, as well as the establishment of a process of demand proceedings. Nevertheless, CNSNS has faced problems in fulfilling these positions due to the combination of the following factors:

- Few qualified personnel in the labor market.
- The large number of contested positions makes the selection process required by the Professional Career Service Law a very slow one, and causes the deviation of an important amount of CNSNS human resources towards its execution.
- Movement of personnel with experience within the CNSNS to other activities with better payment.
- Loss of qualified personnel to other institutions of the sector, due to differences in payment.

Approximately 70% of the available positions were filled by experienced personnel within the Commission, looking for better salaries. Thus the net result was that after the process, 36 positions are still available. CNSNS has made an important effort to make its processes more efficient, in order to maintain surveillance of the installations, supporting this activity with the evaluating personnel, reducing evaluation and licensing activities. In addition, the Laguna Verde Nuclear Power Station new projects involving a 20% power uprate and the Improved Technical Specifications, demands a major effort on the CNSNS, which makes it necessary to hire external consultants in order to meet safety evaluation requirements.

8.4.1 Training of Regulatory Body Staff

The Federal Public Administration started the Professional Career Service Law, which became effective October 7, 2003, and its gradual implementation began on April 5, 2004. This law established the rules which allow a person to enter the Federal Public Administration by a public and open call.

The Professional Career Service is a system that guarantees equality in opportunities to access public service based on merit in order to improve public service performance. The Professional Career Service attracts, retains, motivates and trains public service personnel, guaranteeing that public administration will withstand government changes with the minimum disruption and maximum efficiency.

CNSNS, within its Systematic Approach to Training, concluded the project of "Analysis of Training Requirements to Implement the Reactor Oversight Process (ROP) in the GSN", based on the methodology described in the technical document IAEA-TECDOC-1254 "Training the Staff of the Regulatory Body for Nuclear Facilities: A Competency Framework". As a result of this project, the knowledge, competencies and abilities required for the personnel of the Nuclear Safety Division of CNSNS have been defined to implement the ROP at LVNPS.

8.4.2 Financial Resources

Regarding financial resources, 100% of CNSNS resources are provided by the Mexican Government. The Commission does not receive any income for the evaluation and ruling for the licensing of nuclear facilities or for licenses it issues to the station operators. Although the issuance of licenses for possession, handling and transportation of radioactive material requires a fee, these resources enter directly into the Federation Treasury. The financial resources that the Commission receives are determined by the Department of Treasury based on the previous year's budget. In 2006, CNSNS 's financial resources reached $ 89,870,000 pesos, national currency, about $ 8,200,000 U.S. dollars.

8.5 QUALITY ASSURANCE IN THE REGULATORY BODY

During the second semester of 2003, CNSNS started the implementation of a Quality Management System based on ISO 9001-2000 standard whose objective is to update the previous system based on ISO 9001-1994 Standard The purpose of this effort is not the certification but to have a management system that allows maintaining the proper control and continuous improvement in the regulatory processes.

A Quality Management Manual was prepared for the Nuclear Safety Division. It focuses on the Laguna Verde Station, and on the procedures of the corresponding management for inspection and evaluation processes, based on ISO 9001-2000 Standard, following the recommendations of the Draft Safety Guide DS113 "Management Systems for Regulatory Bodies" of IAEA. The audits of CNSNS began at this time in order to identify areas of improvement to establish preventive and corrective actions. In a further stage, the Quality Management System of GSN shall include the processes of operational experience, nuclear facility licensing, operator licensing and development of standards and guidelines.

8.6 CHALLENGES OF THE REGULATORY BODY

CNSNS is currently facing several challenges due to downsizing policies as well as evaluation requirements and licensing of projects that the LVNPS owner is currently carrying out:

- Layoffs due to austerity policies of the Federal Government.
- New Personnel Training
- Strengthening the infrastructure in order to improve efficiency and effectiveness.
- Safety evaluation requirements for the authorization and licensing of:

    - Improved Technical Specifications
    - 20% licensed power uprate for Laguna Verde Nuclear Power Station reactors

As mentioned above, in the year 2005, CNSNS was authorized to increase its personnel with 50 new positions. This has caused movement within the organization that together with the shortage of qualified personnel in the labor market, caused vacancies in 36 positions in October 2006. Currently, the Commission is requesting authorization to continue with the hiring process.

The entry of new personnel requires an effort in their training due to the shortage of qualified personnel in the labor market. The Commission shall face this challenge through the hiring of consultants for training.

In addition, the Laguna Verde Nuclear Power Station is taking on projects that must be authorized or licensed by the CNSNS. Because of the magnitude of the projects, it will be necessary for the Commission to turn to external consultants in order to fulfill those requirements.

8.7 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

As described in this Article, CNSNS is a semi-autonomous federal organism depending on the Department of Energy and designated as the National Regulatory Body in nuclear safety matters and responsible for the enforcement of the regulatory framework as described in Article 7 of this National Report. It has adequate authority, competency, financial and human resources to fulfill its responsibilities as conferred by Regulatory Law of the Constitutional Article 27.

Therefore, based on the information submitted in this National Report, it can be concluded that the obligations established in Article 8 of the CSN are fully satisfied.

POSITION OF THE CNSNS IN THE FEDERAL GOVERNMENT

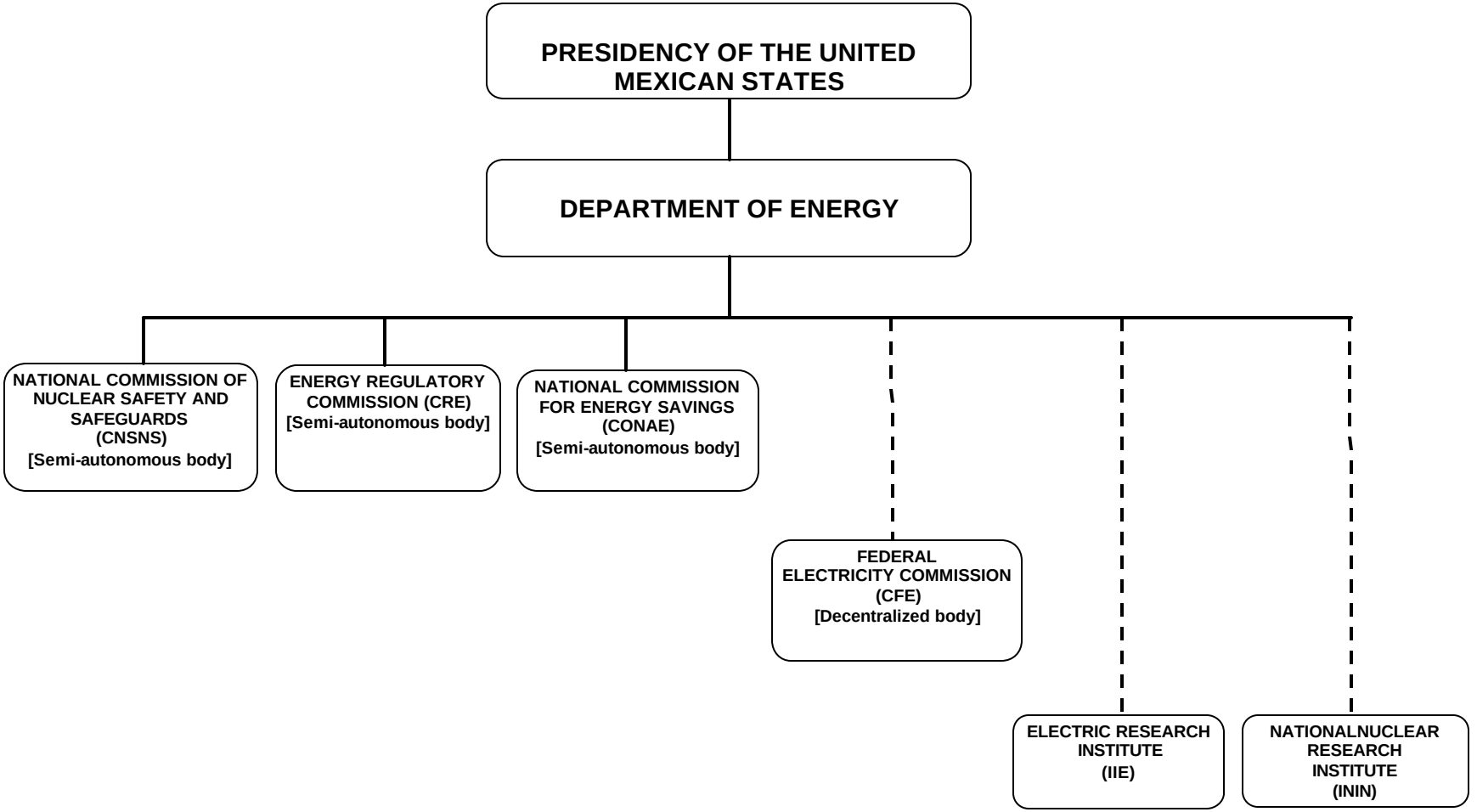


Figure 8.1

ORGANIZATIONAL CHART OF CNSNS

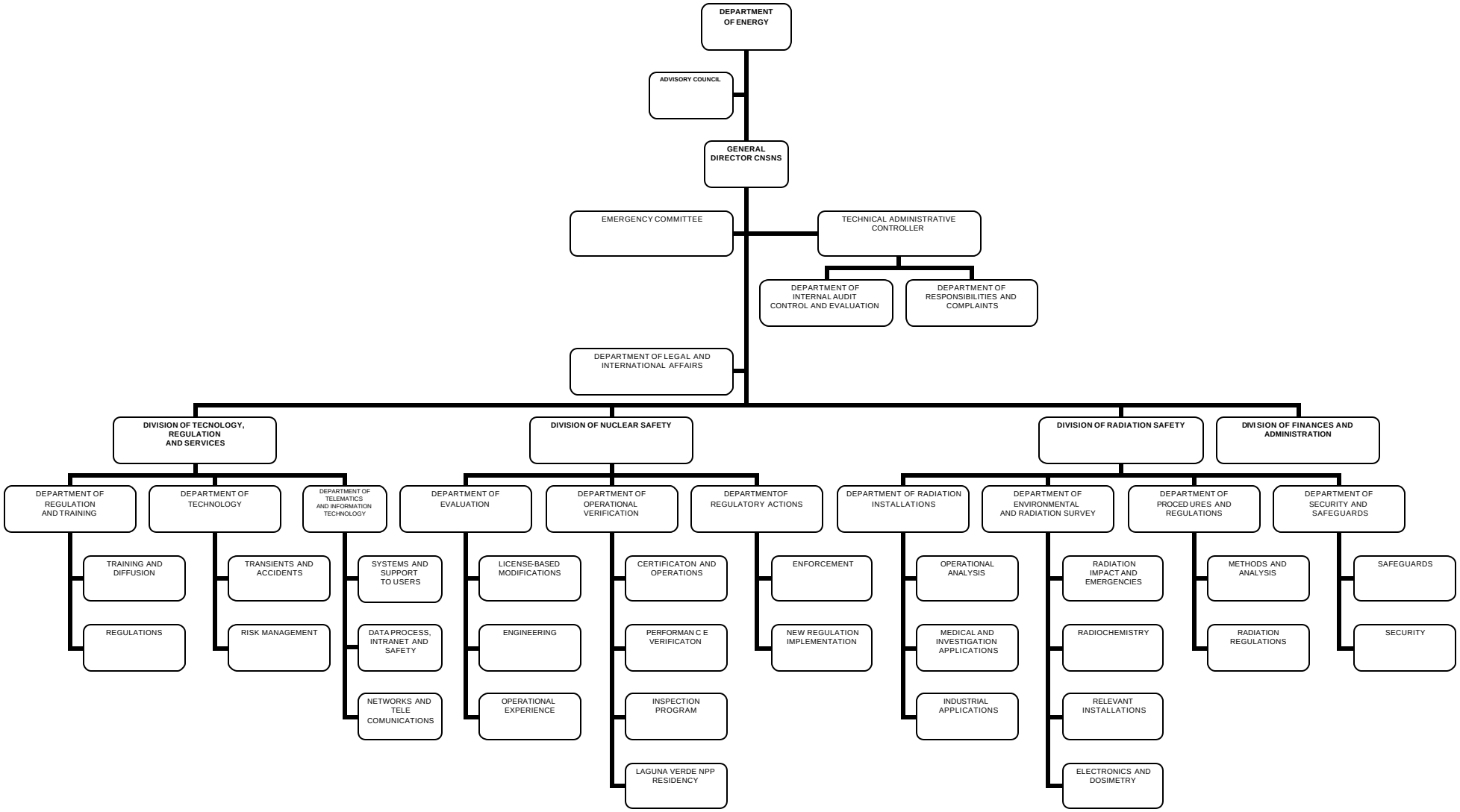


Figure 8.2

EMERGENCY COMMITTEE ORGANIZATION IN CNSNS

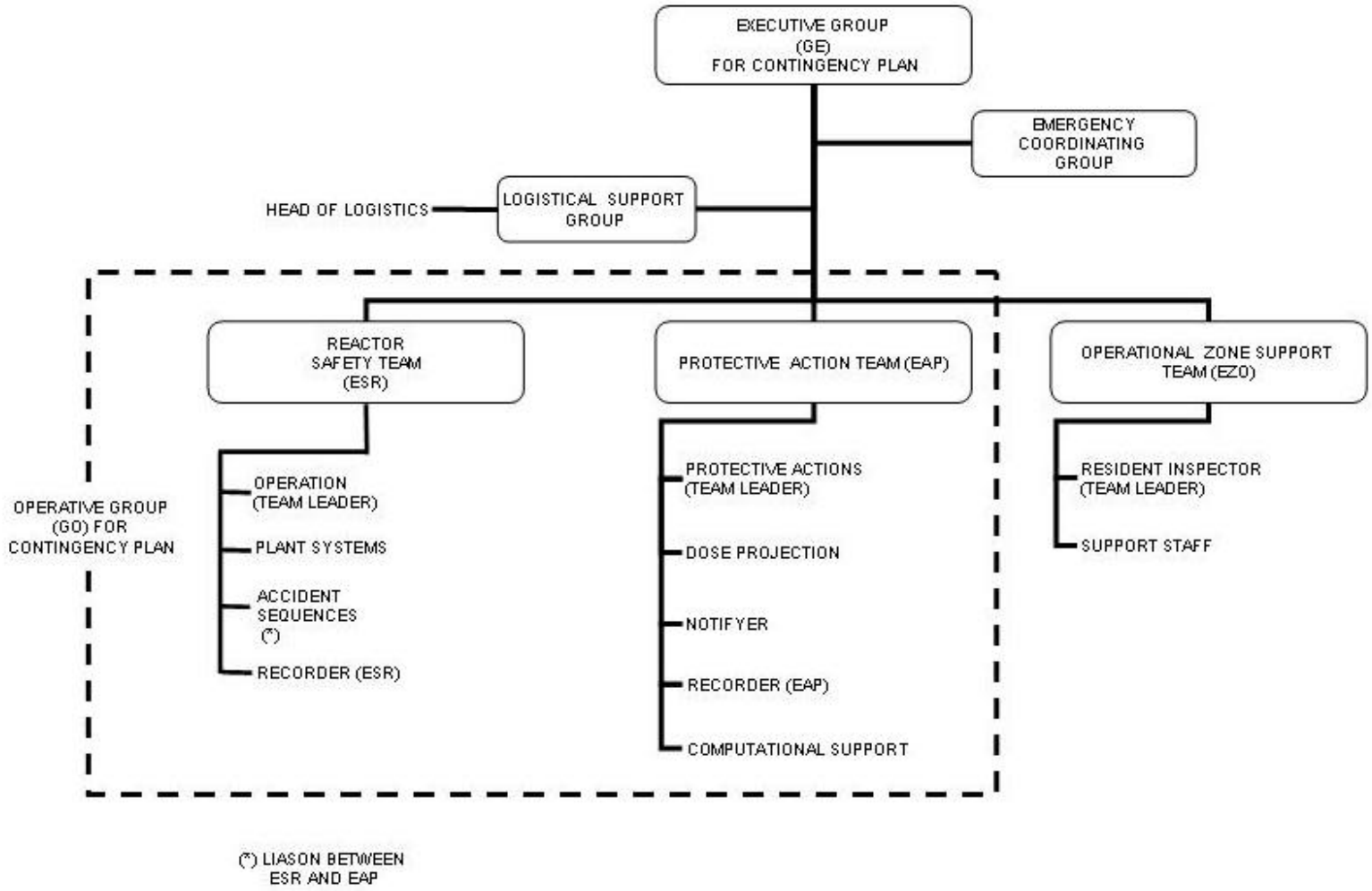


Figure 8.3

ARTICLE 9. RESPONSIBILITY OF THE LICENCE HOLDER

9.1 OBLIGATIONS

"Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility."

9.2 INTRODUCTION

During a considerable period there have been no regulatory legislative changes that affect the requirements that the holder of a license or permit for a nuclear facility must satisfy. As required by The Regulatory Law of the Constitutional Article 27 on Nuclear Matters, the owner of nuclear installations is entirely responsible for ensuring safe operation. The CNSNS activities are devoted to demonstrate that all the organizations that work for CFE, including contractors, develop their activities under set standards and regulations.

The regulatory framework also establishes that nuclear installations must employ the required nuclear and radiological safety personnel, and the holder of any type of license or corresponding authorization shall be responsible for strict compliance with applicable laws.

Furthermore, Article 4 of the Civil Liability Law for Nuclear Damage dated December 29, 1974, states that *"the owner's public liability for nuclear damage is objective",* that is, the nuclear station owner is responsible for possible damages that the installation may originate.

9.3 RESPONSIBILITY OF LICENSE HOLDER

The main responsibilities defined by the National Commission on Nuclear Safety and Safeguards, to be satisfied by the Federal Electricity Commission (owner of Laguna Verde NPP), are contained in the conditions of the License for Commercial Operation of each of the Units of the Laguna Verde Nuclear Power Station.

CFE's responsibility for nuclear safety in Units 1 and 2 of the Laguna Verde Station, is acknowledged and reflected in the Nuclear Power Division's (GCN) Quality Assurance Plan. According to this Plan, CFE's General Director is responsible to the National Commission of Nuclear Safety and Safeguards (CNSNS) for safely operating and modifying Units 1 and 2 of LVNPS, according to guidelines established in the regulatory framework, Operating Licenses, Technical Specifications and Quality Assurance Plan.

9.4 STEPS TAKEN BY THE REGULATORY BODY TO ENSURE THE FULFILLMENT OF LICENSEE'S RESPONSIBILITIES

The National Commission of Nuclear Safety and Safeguards (CNSNS) as a National Regulatory Body, has established several mechanisms to guarantee that the licensee satisfies each of the items related to the obligations required in the Operation License. To this effect there is an annual program for audits, surveillances, inspections and periodic evaluations of all important activities at LVNPS Units 1 & 2.

The program of inspections and audits is based on the importance of the licensee's activities, performance of the installation and personnel in previous inspections or audits, and the number of findings reported by the Regulatory Body and by internal control processes.

Another mechanism by which the Mexican Regulatory Body verifies that CFE complies with the safety obligations established in the Operating License is the evaluation process of design modifications, operational events and of the improvement in safety derived from the that learned from operational experience.

9.5 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

Licensee responsibility and the steps taken by the Regulatory Body to enforce licensee's responsibilities fulfillment have not changed. Therefore, based on information presented in this National Report, it can be concluded that the obligations established in Article 9 of the CSN are satisfied.

ARTICLE 10. PRIORITY TO SAFETY

10.1 OBLIGATIONS

"Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety."

10.2 SAFETY CULTURE AND GOOD PRACTICES

CFE's Nuclear Power Plant Division (GCN) maintains in its Quality Policy that nuclear safety is of higher priority than power production. This was clearly established in the organization's Mission that states: "*To generate electricity by nuclear means with quality and at a minimum cost, with safety as the highest priority, sustained by our personnel's continuous self-improvement and deep respect to the environment".*

GCN's Vision is the following *"To achieve and maintain recognition of the level of excellence of our station by the World Association of Nuclear Operators due to our solid safety culture, high performance personnel and total quality administration."*

GCN principles include:

- Safety: Has absolute priority over any other consideration and is the responsibility of all personnel.
- Responsibility for Results: The will to accept responsibility for our actions and for the results and consequences of them.
- Professional Integrity: Maintain the highest standards in the performance of the Nuclear Industry; to achieve this we must follow the principles of integrity, loyalty, honesty and efficient resource use.
- Continuous Improvement: Use the methodology to Plan, Perform, Verify and Act in all our processes, activities and tasks.
- Team Work: Work with others as a real team. This promotes excellence in the performance of our organization and establishes a harmonious work environment.
- Performance Excellence: All our efforts must be aimed to the achievement of excellence, in other words, to make it better each time.
- Service Quality: Our attitudes and actions are aimed to satisfy expectations of internal and external customers.
- Environmental Protection: We contribute to the conservation of the environment so that future generations can make use of it.

Work continues with the Safety Culture Reinforcement Plan to implement actions for improvement in all areas of LVNPS. Currently, this reinforcement plan provides the guidelines and orientation to reach the following goals:

a) Personnel awareness to assign a higher priority to safety than to any other activity (through workshops, pre-work meetings, previous task reviews, during meetings, in Supervisors' meetings, in Leadership meetings, etc).

b) Surveillance performance through Safety Indicators.

c) Use of Human Performance tools to prevent mistakes.

d) Evaluation, analysis and prioritization of improvement areas in Safety Culture.

The actions and good practices that GCN of the CFE has adopted in relation to safety culture enhancement in its organization are listed below.

1. Nuclear Power Plant Division Strategic Planning

CFE's Nuclear Plant Division's 2006-2010 Strategic Plan is aimed towards the continuous search for excellence, both nationally and internationally, so that Laguna Verde Power Station becomes one of the best on a worldwide scale according to the classification of the World Association of Nuclear Operators (WANO). The Strategic Plan also works towards reinforcing nuclear power as a highly viable option.

The main objective of the 2006-2010 Strategic Plan is the safe operation of the Station, generating clean, economic and competitive electric power, promoting and driving sustainable growth and creating a value to society, to its workers and to CFE as an institution.

It highlights the most extensive principles and ethical values undertaken by Management and its workers, and is based on internal analysis of its strengths and weaknesses and on external analysis of its opportunities and threats.

The Plan establishes, on a five year outlook, its basis in strategic objectives, establishing the expectations, responsibilities, goals, strategies, activities and tasks through Operational Planning, in a framework of continuous enhancement with indicators related to the evaluation of results.

The 2006-2010 Strategic Plan is based on the reinforcement of the total Quality Methodology, for the optimization of internal processes and for facing obligations to the customer, society and the environment. It promotes new certifications such as the one of a socially responsible institution and of a clean industry, among others.

The driving force towards a search for excellence through continuous improvement is, without a doubt, its personnel; therefore, the Plan requires permanent training. That is, to achieve excellence at the Station, personnel with excellence is needed.

The establishing of the Safety Culture Program has also been important, which among other things, diffuses the Safety Culture Mission and Policy (updated in 2006).

1) Coherent actions have been taken in accordance with GCN's Key Objective being that safety has the highest priority in any GCN decision making process.

2) To maintain safe and reliable operation of the LVNPS through improvement in personnel, installation and organizational performance, in the short and medium term.

3) All personnel working in GCN is committed to the next eight principles, to establish a strong Safety Culture in the following way:

Safety Culture Principles	Focus area
Everyone in the organization is responsible for nuclear safety	Communication and teamwork
Leaders demonstrate commitment to safety	Leadership and Management
Confidence permeates the organization	Human performance
Decision making reflects safety first principle	Resources Station condition and reliability Generation loss reduction
Nuclear technology is seen as special and unique	Dose reduction Human performance
A methodology "what happens if" is cultivated	Team work and communication Human performance
The organizational learning is well accepted	Self evaluation and corrective action

Safety Culture Principles	Focus area
Nuclear safety is continuously analyzed	Dose reduction Human performance

4) A Program for Equipment Reliability and an indicator for days with zero events were established. In this way GCN evaluates the improvement of equipment and personnel performance, creating a professional environment that promotes rendering of results and quality improvement.

5) As an example, the following actions have been taken to reach a World Class performance level:

- Reinforcement of Operative Behavior including: Handling of Reactivity, Use of Tools to Prevent Errors and the Follow Up of Critical Parameters during the plant evolutions.
- Definition of Post Maintenance/Modification testing matrixes.
- Revision of Maintenance Rule Process and diffusion of results.
- Reinforcement of on-line supervision, achieving greater permanence in the field for supervision and solution of problems. (Technical Observations Program and Operation and Maintenance Performance Manuals, etc.)
- Defining and establishing the Self Evaluation Process in GCN.
- Changes in Planning Processes for Normal Operation and Refueling.
- Establishment of the Operative Decision Making process focusing on safety as a priority, always with a questioning attitude.
- Implementation of Corrective Action Programs.

6) Information systems for decision making serve as a means for transmitting, in a clear, timely and efficient way, to all GCN personnel the short term expectations and goals for performance of personnel, equipment and processes. In general they are a means of communication for all areas of the Division to provide support in achieving their objectives and goals.

2. Safety Culture Seminars

The Objective of these workshops is to strengthen the principles to continue building an organizational Safety Culture through the following:

- Emphasizing high respect for nuclear technology

- Increasing knowledge, comprehension and application of the Defense in Depth Concept
- Fostering the development and implementation of Good Practices in work and operations.

All GCN personnel have attended these seminars. Moreover, the adoption of Good Practices has been reinforced by use of the Manual of Conduct for personnel from Operations, Maintenance, Systems Engineering, Chemical Engineering, etc.

The courses "Operational decision making", focused on safety and "Conservative decision making", for maintenance, were given.

Reinforcement of operational conduct for handling reactivity, applying tools for error prevention and monitoring critical parameters during plant evolutions.

For the 11th and 12th U1 Refueling Outages and 8th U2 Refueling Outages instruction was given through conferences to emphasize that "No job is so important as to not make it safe".

Establishment of the evaluation "Significant Operating Experience Report 2003-2 Davis Besse", with conferences to all groups of the station to spread word about the event. A survey focused on safety was conducted, resulting in the following areas of improvement:

- Feedback to the originator of the Condition Report about the follow up on the problem reported (equipment and component degradation)
- Diffuse information about engineering programs that handle structure, systems and component degradation.
- Evaluation of the impact on safety of activities that are not included in the program due to lack of spare parts.
- Establish a Managers Meeting for the assignment and grading of the daily Condition Reports from the Corrective Action Program (PAC).
- Ensure that the 12 week Planning meets with the considerations predicted in Risk Management.
- Issue Condition Report trends to review safety impacts.

3. Survey to Measure Safety Culture Level

A survey was applied to determine the level of Safety Culture during the month of June 2006, considering the 8 principles of the WANO-INPO document "Principles for a Strong Nuclear Safety Culture", and the state and physical condition of the installations as main objectives. Results of these surveys indicate several improvement areas which have been attended to as follows:

- A strong leadership and a proactive attitude of GCN Managers toward Safety Culture (review of the strategic planning considering the safety principle as a fundamental factor to achieve a high performance level).
- Giving the highest priority and importance to actions that reinforce the Safety Culture.
- Active participation of Area Heads and Supervisors in Safety Culture reinforcing activities.
- Application of Human Performance improvement tools which have been recognized as a very important methodology to achieve zero events.
- Application of a methodology for conservative decision making for the LVNPS operation.

4. Safety Culture Performance Indicators

Through GCN INTRANET, all CFE personnel have access to indicators directly related to Safety Culture. Currently, the CFE is completing these indicator sets and including others that show aspects of Safety Culture in a more direct way. To achieve this, the managerial procedure “Safety Performance Indicators” is applied.

With IAEA technical assistance, the Nuclear Power Plant Division of CFE is working on the integration of this new indicator set.

5. Assessment of the LVNPS Personnel Perception on Safety Culture

The surveys that CFE has applied since 1998 were modified in the year 2000 and 2006, with a brief questionnaire with the purpose of measuring the LVNPS personnel perception level regarding Safety Culture. This has allowed reassigning resources to those areas that require improvement; and has been useful as a means to verify the effectiveness of actions taken.

Improvements achieved up to date are related mainly to the following actions:

- Improved activities planning
- Incorporation of the previous task review and pre-work meeting in the planning ahead to consider the risks in those activities.
- Effective supervision of personnel and their activities
- Teamwork and communication
- Training (Systematic Approach to Training Method, SAT)
- Attitude change in Managers and Supervisors

- Application and reinforcement of human performance improvement tools
- Improvement and optimization of operating procedures to eliminate precursor errors and to avoid risks.
- Presence of managers in the field

6. Implementation and Continuous Improvement of Safety Culture

Several actions have been taken in order to maintain continuous improvement in Safety Culture issues, some of them are as follow:

- Safety Culture Policy, new edition 2006, Policy of reactivity management, Policy on operation with zero nuclear fuel failure, GCN expectations for the management of operational experience, Policy on Configuration Management, Training Policy, Health and Safety Policy in the job, Environmental Policy, etc.
- Collective Radiological Dose reduction goal during LVNPS refueling outages (achieving the best refueling outages both in minimum time and collective dose)
- Management Policy not to request to CNSNS exceptions to Technical Specifications in LVNPS.
- Application of conservative decisions and “Operative decision making”, focused on safety.
- Reinforcement of operative conduct for handling of reactivity and monitoring of critical parameters during plant evolutions.
- Human Performance training course and tools for the prevention of errors for all GCN personnel
- Updating and application of procedures for planning activities, considering proactive tools of human performance
- Performance of the condition reports evaluation group “GERC” (a special group for root-cause analysis) and of the management level review committee of events for their revision and assignment.
- Diffusion to all GCN personnel in order to stop unsafe jobs.
- Monitoring the workarounds through a trend indicator
- Programs of operational experience, continuous and programmed self evaluations, benchmarking, configuration control, industrial safety, corrective action program, root-cause analysis, human performance improvement program, equipment reliability program, system health program and the systematic approach to training programs are established.
- Improved Technical Specifications (ETOM) are in their final stage in CFE. They are under regulatory review and assessment by CNSNS.

10.3 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

10.3.1 Achievements and Changes in Safety Related Activities

In the period covered by this National Report, safety polices, leading criteria in nuclear safety, strategies to prevent and to control the mobility of nuclear material and continuous practice of Safety Culture in LVNPS have not changed.

In particular, CFE/GCN highlights the following achievements:

- CFE's 2006-2010 New Strategic Plan focused on the continued search for excellence to ensure that LVNPS becomes one of the best plants worldwide.
- Safety Culture Policy updated in 2006.
- Adoption of Collective Radiological Dose reduction goal during LVNPS Refueling Outages achieving the best outages both in time as well as in collective dose.
- Based on application of tools used for error prevention, the number of unplanned transients decreased.

10.3.2 Future safety related activities and foreseen or proposed programs

For the period covered by this National Report and the next report, GCN of CFE will continue implementing the improvement program and abide by procedures to eliminate precursor errors that may lead LVNPS to some undesired event.
?

10.3.3 Safety Concerns and Foreseen Actions

In regards to safety as a priority, it is considered that there are no safety issues of concern, so it is not necessary to implement preventive or corrective measures.

10.4 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

During this period, the development of activities shows the strong commitment both of the regulating body as well as LVNPS management to maintain nuclear safety as an overriding priority over any other concept.

Therefore, based on the information submitted in this National Report, it can be concluded that the obligations established in Article 10 of CSN are satisfied.

ARTICLE 11. FINANCIAL AND HUMAN RESOURCES

11.1 OBLIGATIONS

1. *Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.*

2. *Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.*

11.2 HUMAN RESOURCES

11.2.1 CNSNS Human Resources

Section 8.4 of this National Report presents the information regarding human resources at CNSNS.

11.2.2 CFE/GCN Human Resources

CFE's Nuclear Power Plant Division (GCN) work force consists of 1,322 permanent employees, as of December 2006.

11.2.2.1 CFE Organizational Structure

Currently, CFE is managed by a General Director and directors of the following five divisions: Projects of Financial Investment, Finances, Administration, Operations and Modernization and Structural Change.

Figure 11.1 shows the current organizational structure of CFE.

- **Production**

CFE's total installed effective capacity is currently 47,857.29 MWe and LVNPS contribution is 2.85%:

Source Type	Installed Capacity (MWe)	Percentage (%)
Thermoelectric	32,645.75 MWe	68.22%
Hydroelectric	10,284.98 MWe	21.49%
Coal	2,600.00 MWe	5.43%
Nuclear	1,364.88 MWe	2.85%
Geothermal	959.50 MWe	2.19%
Wind	2.18 MWe	0.01%
T O T A L	**43,857.29 MWe**	**100.00 %**

- **Transmission and Transformation**

In 2006, the national interconnected system had 47,485 Km. of transmission lines with voltages of 400, 230, 161 and 150 Kilovolts (KV), 46,873 Km of sub-transmission lines of 138, 115, 85 and 69 KV and 606,318 Km of distribution lines of 34.5, 23, 13.8, 6.6, 4.16 and 2.4 KV. There was a total of 700,649 Km of transmission, sub-transmission and distribution lines at the national level.

Also in 2006, the transformation capacity was 178,029 MVA; 76.86% of this corresponds to transmission sub-stations and the remaining 23.14% to distribution sub-stations.

The National Electrical System is divided into eight control areas coordinated by the National Center of Energy Control (CENACE), which establishes policies, criteria and standards of operation, as well as operational planning and analysis.

11.2.3.1 GCN Direction and Organization

CFE is the proprietor of LVNPS and CFE's GCN is totally responsible for its design, engineering, construction, operation, maintenance and decommissioning.

The General Director of CFE is responsible in the presence of the CNSNS for operating and modifying LVNPS-1 & 2 in compliance with operating license requirements. Since April 2004, as a result of CFE reorganization, this responsibility was assigned to GCN.

In order to fulfil this responsibility, GCN is structured according to the organizational chart shown in Figure 11.2 indicating the lines of authority and communication between the organizations that conform this division. This organization has been functioning as of the first semester of 2004 and its purpose is to provide

independence between the production area and the technical support areas, including the Training Center.

Engineering and support services for the Operation of LVNPS during the useful life of both Units, depend on the assistant managers of Services and Engineering, respectively. Engineering personnel have demonstrated that they possess the qualifications, experience and knowledge required to carry out their duties.

The requirements of the standard ANSI/ANS 3.1-1981 “Selection, Qualification and Training of Personnel for Nuclear Power Plants” were applied before October 2000. As of November 2000, the requirements of the Mexican Official Norm NOM-NUCL-034-2000 are applied “Selection, Qualification and Training Requirements of Personnel in Nuclear Power Plants”.

In addition to technical support organization, the Nuclear Power Plant Division (GCN) has the Nuclear Safety Vice-Management (which is conformed by Departments of Licensing, Quality Assurance, Quality Control, Operating Verification and Operational Experience and Corrective Action Program, as well as the Independent Equivalent Chief Inspection (Inspector ASME), Environmental Engineering, Medical Services and Industrial Safety) which is independent of the Production organization and is responsible for auditing, surveillance and independent reviews to all operational, maintenance and support services activities.

11.2.3.2 General Manager of Operation (Plant Management)

The General Manager of Operation reports to the Manager of GCN. He is in charge of LVNPS operation and maintenance and is directly responsible for compliance with and maintaining the Operating License of the LVNPS Units 1 & 2 and Radiation Protection and ALARA programs.

The main functional areas under direct supervision of the General Manager of Operation are: Production, Maintenance, Work Management, Radiation Protection, Reactor Engineering, Outage Refueling (See Figure 11.2 of this National Report).

11.2.3.3 Vice-Management of Production

The Vice-Manager of Production reports to the General Manager of Operation and is in charge of the LVNPS operation and control.

The main functional areas under direct supervision of the Vice-Manager of Production are: Operation U-1, Operation U-2 and Chemical Engineering and Radioactive Waste (See Figure 11.2 of this National Report).

The line of authority and emission of special temporary orders during contingencies is the following:

a) Vice-Manager of Production

b) Supervisors of Operation (U1 and U2)

c) Shift Supervisor (U1 and U2)

As reported in the past National Reports (see Annex II), the Operation Groups are assigned to Unit 1 and Unit 2, based on shift roles. The personnel are not shared between units (except yard personnel); however, they could be completely transferred if previous training requirements are satisfied.

There are 6 shifts per unit to cover the 24 hours a day, 7 days a week, and an allowance for the Continuous Retraining Program, vacations and incidentals that could occur.

11.2.3.4 Vice-Management of Maintenance

The Vice-Manager of Maintenance reports to General Manager of Operation and is responsible for preventive and corrective maintenance activities and modifications to LVNPS related to Mechanical, Electrical, Instrumentation and Control and Civil disciplines; also Metrology Laboratory, as well as the implementation of In Service Inspection and Spare Parts programs.

The main functional areas under direct supervision of the Vice-Manager of Maintenance are: Mechanical Maintenance, Instrumentation and Control Maintenance, Electrical Maintenance, Construction Support, Technical Assistance for Maintenance and Special Programs (See Figure 11.2 of this National Report).

11.2.3.5 Vice-Management of Services

The Vice-Manager of Services reports to the GCN Manager and has the responsibility of providing daily support to the General Superintendent of Operation in the areas of training, computer systems, communications and infrastructure. To fulfill this responsibility, he receives support from the areas of Training, Computer Systems, Communications and Infrastructure (See Figure 11.2 of this National Report).

The Vice-Management of Services has the support of the Head of the Training Center, who is responsible for planning, coordinating and executing the training programs for LVNPS licensed and non-licensed personnel, as well as the operation and maintenance of the simulator's hardware and software.

11.2.3.6 Vice-Management of Engineering

The Vice-Manager of Engineering reports to the GCN Manager. He has the responsibility of providing engineering support to General Management of Operation, as well as to the Vice-Managers of Services and Nuclear Safety. Moreover he is responsible for maintaining LVNPS Engineering Design Bases, Configuration Control,

Modifications Program, Investment Protection (equipment and components aging program) and Radwaste Disposal. To fulfill these responsibilities, the Vice-Manager of Engineering has the following departments: Design Engineering, Systems Engineering, Technical Management, Site Engineering, "Fix it now" Team (Quick Response), Coordination of Projects and Radwaste Final Disposal (See Figure 11.2 of this National Report).

11.2.3.7 Vice-Management of Nuclear Safety

The Vice-Manager of Nuclear Safety reports to GCN Manager. He is responsible for reviews and audits of all safety related activities or those covered by the Quality Assurance Program. The review and audit program has the objectives of reviewing important changes proposed to systems or procedures, tests and experiments, assuring that safety significant unusual events are investigated and corrected immediately, reducing the probability of recurrence, and detecting unnoticed tendencies. Furthermore he is responsible for the implementation of the LVNPS Environmental Monitoring Program. To fulfill these responsibilities, the Vice-Manager of Nuclear Safety receives support from Quality Assurance, Quality Control, Licensing, Operative Verification and Operational Experience, Corrective Action Program, Independent Equivalent Inspection (ASME Inspector) Environmental Engineering, Medical Services and Industrial Safety (See Figure 11.2 of this National Report).

11.2.3.8 Review and Assessment Committees

In order to review operational safety related activities, the review program has been developed at three levels. The first at the LVNPS operation level: Site Operations Review Committee (CROS). Second, on the corporate level: Independent Operations Review Committee (CIRO) and the third, as an independent self-assessment body: Independent Safety Engineering Unit (UIIS). The CROS, made up of Production, Maintenance, Services, Engineering and Nuclear Safety personnel, reviews operations activities and advises LVNPS Manager of Operation. The CIRO, involving Vice-Managers who are not directly responsible for LVNPS operation, serves as an independent review group that carries out reviews, assessments and audits.

Additionally, on a routine basis, the Quality Assurance organization formulates and executes an audits/surveillance program to verify compliance with the Operation Quality Assurance Program (See Article 13 of this National Report).

- **Site Operations Review Committee (CROS)**

The CROS is a committee chaired by LVNPS General Superintendent of Operation, having as Vice-President the Vice-Manager of Production and the members are the supervisors of the following: Training Center, Operation U1, Operation U2, Reactor Engineering, Technical Assistance for Maintenance, Systems Engineering, Radiation Protection, Work & Administrative Assistant, Quality Control, Site Engineering,

Instrumentation and Control Maintenance, and Operating Verification and Operational Experience. The latter acts as Secretary.

- **Independent Operations Review Committee (CIRO)**

The Independent Operations Review Committee (CIRO) is chaired by the GCN Manager. The permanent members of this Committee are: General Manager of Operation, Vice-Manager of Engineering, Vice-Manager of Production, Vice-Manager of Services, Vice-Manager of Nuclear Safety, Vice-Manager of Maintenance, Head of Independent Safety Engineering Unit, Head of Quality Assurance and the Head of Licensing.

The Independent Operations Review Committee (CIRO) delegates to the Quality Assurance Department the execution of audits, except those applicable to Physical Security which are carried out by the Licensing Department.

11.2 TRAINING AND RETRAINING PROGRAM

11.3.1 Training Program

LVNPS has established systematic training programs based on the SAT methodology (Systematic Approach to Training, Ref. TR-380 / IAEA) for positions regarding safety and reliability of the station.

Training programs developed under this methodology have been designed based on an analysis of the positions and their main activities. For its implementation, a process has been established, whose effectiveness is evaluated during the training.

Systematic training programs cover the areas of Operation, Maintenance and Technical Support of the Nuclear Station.

11.3.2 Retraining Program

Re-training programs are designed considering several sources of information, such as: the competencies that personnel must maintain for the correct performance of their duties, plant, equipment and procedure modifications, as well as operational experience.

11.4 FUNDS FOR RADWASTE DISPOSAL AND DECOMMISSIONING OF LVNPS

Since January 1999, LVNPS has been creating a fund of 0.00026 U.S. dollars per Kilowatt-hour generated, integrated into the costs of production, for the future storage of radwaste disposal and decommissioning.

CFE has proposed to CNSNS to continue with the SAFSTOR procedure established in NUREG-6174, defining five work stages:

a) Planning, regulatory review, engineering and preparation for reactor final shutdown.

b) Unit deactivation and preparation for decommissioning.

c) Safe removal period of reactor spent fuel to the spent fuel pool, maintaining the core in the pool (5 to 6 years).

d) Extended period of safe fuel storage (approximately 60 years).

e) Decontamination and decommissioning and at the end of the Decommissioning License (60 years).

The above proposal is being reviewed by the Regulatory Body.

Also, as a method to ensure fulfillment of regulatory provisions, CNSNS defines specific requirements in the current Licenses for Commercial Operation of LVNPS Units 1 and 2. These requirements provide the basis for the solution of two very important issues: radioactive waste and decommissioning:

"3. LVNPS must develop and submit to CNSNS strategic plans for definitive storage of medium and low level radioactive waste or the temporary solution options to the need for storage space. Additionally it must have an installation specially dedicated to equipment decontamination and segregation of radioactive material."

"4. The CFE-LVNPS should develop a strategy and the financial mechanisms to guarantee that it will have the necessary financial resources to carry out the decommissioning of the installation at the end of its life (No matter what option is chosen)".

CFE has fulfilled the concern in Requirement 4 and as for Requirement 3, A working program has been established with the Department of Energy to define the Policy on Radwaste Disposal and the modifications to the Nuclear Law. Mexico has received technical support from IAEA on the subject of radwaste.

11.5 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

11.5.1 Achievements and Changes in Safety Related Activities

In the period covered by this National Report, from the point of view of human and financial resources, CFE and GCN organizations (LVNPS operating entity) have achieved the following changes and goals:

- Organization.- As a result of a processes review for resource optimization, CFE's organization was restructured (see Figure 11.2).
- Training.- Radiation Protection, Chemistry Engineering, Operation, Engineering, Training and Maintenance supervisors have participated in WANO Seminars for Professional Development. These seminars have helped to reinforce the Nuclear Safety concepts, Conservative Decisions and Operational Decision Making.

The purpose of incorporating Operational Experience into training programs is to reinforce the concepts mentioned above.

11.5.2 Future Safety Related Activities and Foreseen or Proposed Programs

In LVNPS, in the middle of 2003 the purchase of a new simulator for operator training was authorized. In August 2005, the use of this simulator for initial and continuous training was authorized. This allowed for the re-training of licensed personnel and 4 basic courses entitled "Initial simulator", 3 courses for license preparation and 1 course for SRO promotion to become Shift Supervisor. During 2007, the simulator is being updated in order to maintain physical fidelity with the reference unit.

11.5.3 Safety Concern and Foreseen Actions

A major concern at Laguna Verde is the aging work force; approximately 245 workers will retire between 2007 and 2010 (directors, specialized technicians and administrators). Since there is only one nuclear station in Mexico, there is a low demand for students in the few universities that have a nuclear program. For this reason, the plant has developed Strategic Plan 6: "Retirement and replacement Index" under which the problem is closely followed by GCN Management. Since 2003 the LVNPS has initiated an intensive recruiting and training program to qualify people to replace retired workers.

11.6 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

Based on information provided in previous sections, it can be concluded that the obligations of the Convention on Nuclear Safety are met; that is, to ensure enough

financial resources to allow the preservation and continuous improvement of the nuclear facilities, as well as permanent training and development of personnel, in order to ensure a high level of quality and maintain up-to-date facilities and competent human resources to guarantee safe operation.

Therefore, based on the information submitted in this National Report, it can be concluded that obligations established in Article 11 of the CSN are satisfied.

Figure 11.1

FEDERAL COMMISSION OF ELECTRICITY (CFE)
CFE ORGANIZATION CHART AND NUCLEAR POWER PLANT DIVISION

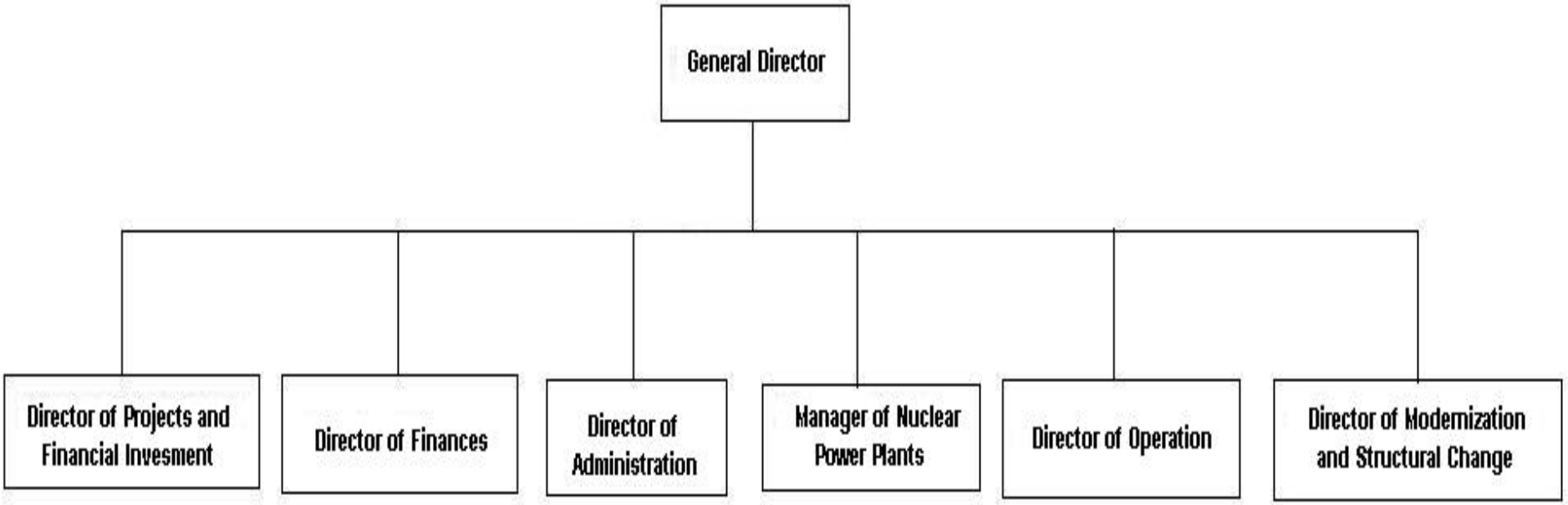
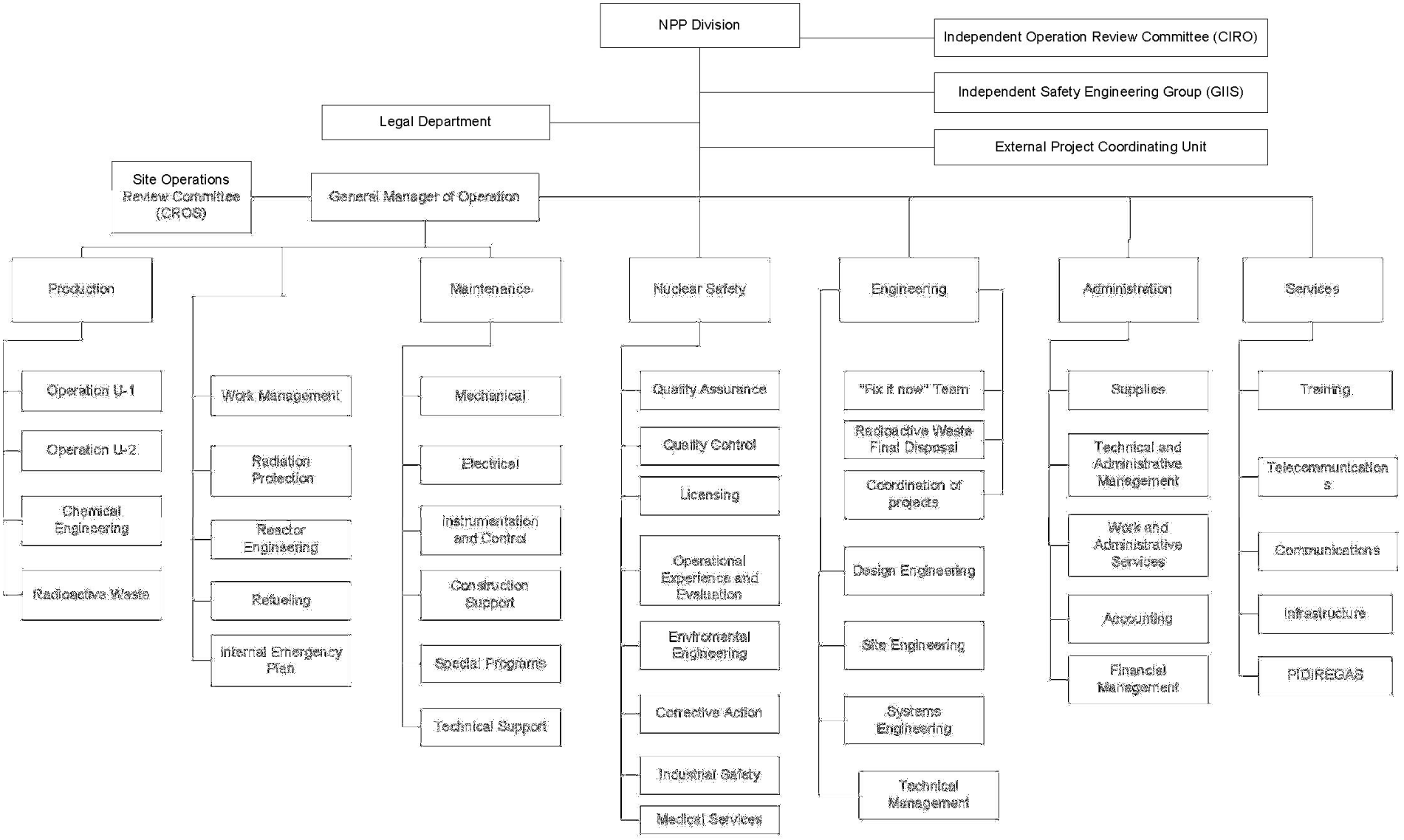


Figure 11.2

FEDERAL COMMISSION OF ELECTRICITY (CFE)
NUCLEAR POWER PLANT DIVISION ORGANIZATION CHART



ARTICLE 12. HUMAN FACTORS

12.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

12.2 CURRENT SITUATION

The CFE Nuclear Power Plant Division (GCN) has implemented the 2006-2010 Strategic Plan, which is focused on the continuous search for excellence both nationally and internationally, to convert the Laguna Verde Power Station into one of the best on a worldwide scale according to the classification of the World Association of Nuclear Operators (WANO). The Strategic Plan also aims to reinforce the nuclear option as a highly viable one.

The main objective of 2006-2010 The Strategic Plan for the period 2006-2010 is focused to the safe operation of the Station, generating clean, economic and competitive electric power, promoting and driving Sustainable Development and creating a value to society, to its workers and to CFE as institution.

The plan is based on strategic objectives. Through Operational Planning it establishes the expectations, responsibilities, goals, strategies, activities and tasks, in a framework of continuous improvement with associated indicators for the evaluation of results. This is the main strategy for performance improvement of Laguna Verde Nuclear Power Station (LVNPS). It establishes strategic objectives (expectations and goals) for the performance of plant personnel, equipment, processes and organizations.

The plan includes eight Strategic Objectives:

1.- Establish Laguna Verde Nuclear Power Station as one of the best worldwide, according to the World Association of Nuclear Operators (WANO); reaching and maintaining the highest standards of Safety and Operation.
2.- Increase competitiveness, generating electricity safely, with quality and at low cost, satisfy and exceed the expectations of our customer (CENACE), through improvement of systems and processes.
3.- Reinforce the application of Total Quality Model with the purpose to maintain and obtain certifications and credentials applicable to the sector.
4.- Increase production of Units 1 and 2 substantially, through the Extended Power Uprate.

5.- Promote Sustainable Development in LVNPS through social development programs and contribute to environmental protection.

6.- Intensify personnel training with programs that rely on highly qualified human resources, ensuring transfer of experience in the generational transition.

7.- Implement actions to drive innovation in execution of activities by use of personnel creativity, advanced technology and teamwork.

A series of strategic projects are also included, such as:

- Equipment obsolescence
- Index of Replacement and Retirement of Personnel
- Annual Reinforcement of the Human Performance Program
- Technological Innovation

An issue arose during the start-up test stage in both units of LVNPS due to configuration problems that were revealed by malfunctioning alarms. For this reason, the Program for Alarm Reduction in the Main Control Room in LVNPS was initiated. This program was developed with the objective of reaching a “Black Board” condition. Within the period of this National Report 2004-2006, CFE activities that have been concluded consist of mostly application of preventive maintenance and modifications to the original design. These activities are being evaluated by CNSNS for their possible closure.

12.3 FURTHER STEPS CONTRIBUTING TO PREVENT HUMAN ERROR AND IMPROVE MAN-MACHINE INTERACTION

The Strategic Objectives No. 1, 6 and 7 in section 12.2 include, the application and reinforcement of tools to prevent errors, self-evaluation programs, benchmarking, observations program, presence of managers at the work site, corrective actions program, documental configuration and Systematic Approach to Training (SAT). These are the approaches used by GCN for improving man-machine interaction, processes, teamwork and training.

To approach and satisfy these Strategic Objectives, several specific initiatives have been developed to improve management processes, programs, procedures and all GCN organizational performance.

Among these initiatives it is important to point out the following:

- Quality culture improvement
- Implementation of Improved Technical Specifications

- Personnel Performance improvement through knowledge of Human Performance Principles and its application in activities at the station, based on a proactive attitude to prevent errors in order to reach a safe and reliable performance.
- Personnel training enhancement.
- Increased Safety and health for personnel at work.
- Reinforcement of error reduction techniques through the use of scale-models or mock ups.
- Implementation of strategies for Safety Culture improvement
- To continue with the integration of the Computer Systems to GCN database
- Improvement of operative procedures

The Human Performance Department of GCN/CFE established its own strategic objectives in order to better satisfy the above:

1. Promote a vision of operation free of human performance errors through the GCN
2. Establish a program that promotes human performance excellence through conduct that supports safety, reliability and operation that is foreseeable through continuous communication between different areas of GCN.
3. Establish the standards, measures, principles and implementation of the methods of a human performance program.
4. Promote a learning environment where self-criticism and non defensive conduct is the standard and “what and how” instead of “who” prevails.
5. Minimize conditions leading to error, through promotion of a safety culture where all workers identify and correct those conditions through the Observation Program and the Corrective Action Program (PAC).
6. Establish an indicator of days without events caused by human error, by counting the days passed without events caused by human error that result in an Level 1 and 2 Adverse Condition to Quality (CAC).

Human performance initiatives have contributed to dose and contamination reduction, and have intrinsically reduced refueling outage time. Important schemes of organizational effectiveness have been present in conservative decision making, which establish safety as a primary element in a decision under any circumstance. These decisions are remarkable during operation and refueling outages at LVNPS.

The use of tools for error prevention has been reinforced by establishing pre-work meetings and the review of the task before performing it. Visual campaigns have been used to further reinforce the concept, such as using posters, leaflets, bulletins, manuals and daily notifications through Intranet, as well as the human performance web page.

Coaching and the presence of managers in the field have strengthened the organization's confidence level, maintaining continuity and improvement at the installations. (Housekeeping & Material Conditions).

The Strategic planning initiative and development in GCN is observed as a strength in the organizational development segment.

Regarding operative aids, the following is an update:

- Currently, the Safety Parameter Display System (SPDS) is included in simulator training in transient and emergency scenarios.
- All personnel from the GCN, in specific from Operation, Maintenance and Chemical Engineering, Reactor Engineering, Support Engineering and Radiation Protection, have attended the course on the Human Performance Principles for Prevention of Errors.

Additionally, main control room personnel of both LVNPS units have been trained in conservative decision making. During the last three years, technical personnel have attended the retraining course on Human Performance Principles. use of tools to prevent errors and events (among others: three-way communication, pre-work meeting, peer-review, self-verification, strict fulfillment of procedures and independent verifications, among others).

12.4 THE ROLE OF THE REGULATORY BODY IN REDUCING EVENTS CAUSED BY HUMAN FACTORS

12.4.1 New Simulator

The Federal Electricity Commission (CFE) decided to modernize the simulator so it would meet the current applicable standards. It based its decision on the natural degradation of the previous simulator due to its extended use and because of the technological advances in computer systems and existing simulation tools. This was also recommended by government and non government bodies such as: the National Commission on Nuclear Safety and Safeguards (CNSNS), the World Association of Nuclear Operators (WANO), and the German Company TÜV which technically audited LVNPS.

The contract for the simulator modernization was signed on May 30, 2003 with a delivery term of 24 months. The work officially began on June 13, 2003 and concluded with the CFE's "Ready for Training" statement on August 16, 2005.

The GCN/CFE decided that the new simulator and its auxiliary systems would be considered plant systems and form part of the Configuration Control System under

the Vice-Management of Engineering. The Quality Assurance Plan would be applicable to the simulator software (for software important to safety).

On June 2005, CFE requested from CNSNS the authorization to use the new LVNPS Unit 2 simulator for the training and re-training of licensed personnel.

On July 2005, CFE carried out for the first time the New Simulator Certification tests of LVNPS. CNSNS witnessed these tests through its inspection process, and concluded that these tests were not satisfactory.

On August 2005, CFE carried out for the second time the New Simulator Certification tests. CNSNS witnessed these tests through another inspection process and preliminary results concluded that the tests were satisfactory. Based on this, CFE submitted the "Executive Report for the Simulator Certification" to CNSNS for consideration, which covered the points required by CNSNS for its approval. Finally, CNSNS granted CFE the preliminary approval for simulator use in refresher training and initial training as of September 5, 2005. This recommendation was based on the initial the compliance with ANSI/ANS-3.5-1998.

Currently CNSNS is writing the "Safety Evaluation Report", to grant final authorization of the simulator.

12.4.2 Alarms Reduction Program

This program was required by the Regulatory Body within the period of this National Report 2004-2006, under CNSNS regulatory actions. Most of the activities of this program have been concluded through the application of preventive maintenance and modifications to the original design.

12.5 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

12.5.1 Achievements and Changes in Safety Related Activities

Within the period of this National Report the following achievements and changes can be mentioned:

- The use of tools for error prevention continued, especially among LVNPS operation groups who performed their activities routinely in the Control Room, simulator, workshops, etc.
- Human performance initiatives have contributed to dose and contamination reduction, and intrinsically to reduction in refueling outage time. Important plans for organizational effectiveness have been presented in conservative decision making, which establishes safety as a primary element in any decision.

- In addition to the SPDS, the Risk Monitor was installed in the Control Room of both LVNPS units. Currently is used for operator decision-making and in the simulator as support to assess real or potential changes in the Core Damage Frequency under configuration changes.
- CNSNS granted CFE the preliminary approval of the use of simulator in re-training and initial training activities for personnel. Therefore, LVNPS has a new simulator with three-dimensional core models. Also, a classroom simulator was purchased, which is an important tool for licensed and licensable personnel of LVNPS.
- CFE has concluded most of the Alarm Reduction Program activities so the possibility of occurrence of events related to human factors have been reduced.
- Regarding the replacement of instrumentation due to obsolescence or for improvement; human factors have always been considered since its conception in Engineering. Also, the respective change documents are reviewed from a field perspective by groups from Systems Engineering, Operation and Maintenance.

12.5.2 Future Safety Related Activities and Foreseen or Proposed Programs

In the period of this National Report and that corresponding to the next report:

- Implementation of the 2006-2010 Strategic Plan of GCN/CFE will continue as the main strategy to reach and keep the improvement of LVNPS performance (Section 12.2 of this National Report).
- During 2007, reinforcement of the use of human performance tools in all LVNPS areas will continue, especially for safety related activities. (e. g. pre-work interdisciplinary meetings).
- In particular, the Regulatory Body is planning to initiate and follow up the assessment of impact on LVNPS safety due to its organization and management, through the development of a systematic methodology that allows an objective assessment of this topic.

12.5.3 Safety Concerns and Foreseen Actions

As for human factors, the Regulatory Body and LVNPS owner consider that there are no concerns regarding safety issues, so there is no need for implementation of preventive and corrective actions.

12.6 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

As shown in previous sections, the consideration of Human Factors through the execution of a detailed review of the control room design, modifications, implementation of a Safety Parameter Display System (SPDS), development and

implementation of symptom based emergency procedures, the program for alarm reduction and the practice of tasks on the simulator as well as the inclusion of operational experience on human errors and the results of surveillance and inspection activities performed by CNSNS, it can be stated that Human Factors for LVNPS has been taken into account from its design, during routine operation and during the eventual occurrence of transients and operational incidents.

Therefore, based on the information presented in this National Report, it can be concluded that the obligations of the Article 12 of the CSN are satisfied.

ARTICLE 13. QUALITY ASSURANCE

13.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

13.2 QUALITY ASSURANCE PLAN IN OPERATION

13.2.1 Corrective Actions

The Laguna Verde Nuclear Power Station has an integrated corrective action control system, the Corrective Action Program (PAC), similar to those used in several U.S.A. power plants. Condition Reports are identified through this program and must be evaluated in relation to Nuclear Safety, and may be classified as Adverse Quality Conditions (CAC) levels 1, 2 or 3, Non Adverse Quality Conditions (CNAC) and Administrative Conditions. CAC Level 1 has the highest hierarchical value.

13.3 OTHER QUALITY ASSURANCE PROGRAMS

The CFE Nuclear Power Plant Division has a permanent policy of continuous improvement in its global quality system by which it has been able to certify the organization in Systems of Quality Management, Environmental Protection and Health & Safety at Work, abiding by the national standards described below:

1997 Certification NMX-CC-9001-1994, equivalent to ISO 9001:1994 (Quality)

1999 Certification NMX-SAA-14001-1996, equivalent to ISO 14001:1996 (environmental protection)

2002 Certification NMX-SAST-01:2000 equivalent to OHSAS 18001:1999 (safety at work)

2003 Certification NMX-CC-9001-2000, equivalent to ISO 9001:2000

2005 Integration of Quality Management, Environmental Protection and Industrial Safety Systems (SACPASI).

2006 Migration to Standard NMX-SAA-14001:2004 equivalent to ISO 14001:2004

2006 Certification of Clean Industry, from the Federal Attorney's Office to Environmental Protection (PROFEPA)

2006 Re-certification of ISO 9001:2000, ISO 14001:2004 and NMX-SAST-01:2000 in an integral way (SACPASI)

13.4 REGULATORY BODY ACTIVITIES IN THE NUCLEAR INSTALLATIONS

The CNSNS has evaluated and approved, before its implementation, each version of the Quality Assurance Plan issued by LVNPS for construction and operation stage. During the period of this National Report (2004-2006), modifications to the Quality Assurance Plan Revision 9 have been submitted to CNSNS. The most relevant changes are listed below:

a) Changes that reflect the new organizational structure of GCN and redistribution of duties and responsibilities.
b) The incorporation of an Online Independent Verifier, who shall inspect maintenance and routine test activities.
c) The process for revision and approval of procedures.

In this way, CFE is substantially improving the quality of activities carried out in LVNPS with the philosophy that changes are based on quality assurance principles.

13.5 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

13.5.1 Achievements and Changes in Safety Related Activities

To reinforce and provide certainty to the global quality system and improve the LVNPS safety, the Environmental and Metrology Engineering laboratories were accredited, and the Clean Industry Certification was awarded on the following dates.

1995 Accreditation of the Environmental Engineering Laboratory

2006 Accreditation of the Metrology Laboratory

2006 Certification of Clean Industry

13.5.2 Future safety related activities and foreseen or proposed programs

Within the period covered by this National Report and that corresponding to the next National Report, problems detected by the Regulatory Body (See section 13.4 of this National Report) will receive special attention, until their definitive resolution.

LVNPS will continue maintaining the certifications and accreditations stated in section 13.5.1 of this National Report.

13.5.3 Safety Concerns and Foreseen Actions

As for Quality Assessment, the Regulatory Body and the LVNPS owner consider that there are no safety concerns so the implementation of any preventive or corrective action is not necessary.

13.6 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

As described in previous sections, since the early stages of design, construction, start up testing and operation of LVNPS Units-1 & 2, the implementation of the Quality Assurance Programs is a requirement that has been requested, applied and inspected for all activities important to safety.

During the period of this National Report and in order to fulfill the obligations of the Convention on Nuclear Safety, the Mexican Regulatory Body (CNSNS) has evaluated the modifications to the Quality Assurance Plan submitted by CFE / Laguna Verde Nuclear Power Station. Additionally, CNSNS has assessed periodically the adequacy of the Quality Assurance Operation Plan and has found that these activities are adequate and fulfill the applicable standards and regulations. Likewise, the proprietor of LVNPS implements a permanent policy of continuous improvement in its global quality system.

Therefore, based on the information presented in this National Report, it can be concluded that obligations stated in Article 13 of the CSN are satisfied.

ARTICLE 14. ASSESSMENT AND VERIFICATION OF SAFETY

14.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that:

I. Comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

II. Verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

14.2 SAFETY ASSESSMENT, OPERATIONAL STAGE

14.2.1 Evaluations/Surveillance by LVNPS Organizations

In this National Report the Figures 14.1 and 14.2 have been updated. They show a summary of evaluations carried out by LVNPS-1 & 2 since the beginning of commercial operation up through December 2006 for the following types of modifications:

PM	Modification Package
PMM	Minor Modification Package
PMMD	Minor Documental Modification Package
PERC	Component Replacement Evaluation Package
PMDT	Technical Documentary Modification Package
PCPA	Set Point Change Package
PyD	Jumper and Disconnection
PROC	Procedures
PMRC	Component Replacement Modification Package
SMT	Temporary Modification Request
ESPEC	Design Specifications
PMS	Software Modification Package
VARIOS	Miscellaneous Documents

14.2.2 External Evaluations/Verifications to LVNPS

14.2.2.1 External Evaluations/Verifications Performed by CNSNS

Evaluations:

CNSNS surveys that the operation of LVNPS does not represent an undue risk to public safety and health through the following activities: Evaluation, Inspection, Licensing of Nuclear Installations, Licensing of Operators and Enforcement.

During LVNPS operation stage detailed evaluations have been conducted in the 2004-2006 period for special problems and topics that have attracted attention because of their relevance to nuclear safety. Some examples include the following:

a) An alternate shutdown cooling method with suction from the Spent Fuel Pool Skimmer.

b) Structural integrity of reactor core shroud with relevant indications.

c) Improved Technical Specifications.

d) Period extension for primary containment leak testing periods, supported by Option B in Appendix J, 10 CFR 50.

e) Detection and suppression system for core power oscillations.

f) Valves to optimize the inerting and de-inerting of the primary containment.

g) Modification of the refueling platform.

h) Method to show the operability of a motorized valve without previous diagnosis testing.

i) Maintenance of the environmental qualification for equipment important to safety.

The main evaluation effort for the 2004-2006 period is described in a) above, requiring the evaluation of the CFE application for licensing in LVNPS Both units the Alternate Shutdown Cooling Method that suctions from the spent fuel pool skimmers, passes through piping of the Residual Heat Removal System (RHR) and returns to the reactor vessel through the recirculation lines.

This activity shall be carried out during the refueling outages in LVNPS 1 and 2, with the reactor cavity flooded and the sluice gates from the spent fuel pool removed. The purpose of the system was to allow repairing activities or maintenance of valves, without unloading the complete reactor core to the spent fuel pool.

This CNSNS evaluation included, among others, areas such as: structural integrity, material engineering, thermal analysis, probabilistic safety analysis, Technical Specifications, etc.

Inspection:

The main inspected areas during LVNPS operation are: Operation, Radiation Protection, Maintenance, Engineering, Emergency Preparedness, Quality Assurance and Personnel Supervisor Performance.

Some deficiencies were detected in these inspections; nevertheless, the analysis determined that they do not contribute to increased risk for defense in depth barriers of LVNPS.

Also, special inspections are carried out (unplanned, reactive and augmented) in response to uncommon situations or events. In the period covered by this National Report, the main events that required this type of inspections were:

- Verification of activities related to radiation protection at LVNPS, concerning handling of ionizing radiation sources by the contractors.
- Verification that the stored equipment and components in spent fuel pool fulfill the design requirements.
- Investigation of causes that originated degradation of performance indicators in the strategic areas of physical and radiological safety.

On the other hand, as part of the program of adopting and adapting the Reactor Oversight Process (ROP) developed by USNRC, CNSNS has evaluated a total of 13 trimesters of plant operation, since 2003 until the second quarter of 2006

The trend shown during this period (See Figure 14-3 of this National Report) through the application of the ROP Regulatory Action Matrix requires three meetings to discuss the plant performance with LVNPS management levels, as well as two reactive inspections related to the degradation of some performance indicators.

This follow-up together with actions taken by the license holder have improved the installation performance, so the CNSNS maintains constant surveillance in order to provide an anticipated response to any trend that indicates degradation in installation performance.

14.2.2.2 External Assessments Performed by Others

In the month of December 2004, a third evaluation was carried out by WANO. The result was the identification of 11 strengths and 15 improvement areas. The most relevant of this is that in the management effectiveness area two strengths were detected and no improvement areas. The corresponding action plans for each

improvement area were made. The goal is to reach Level I in the 2006 revision. In 2006, WANO acknowledged LVNPS to be the best performing plant in the world outside the United States during the year 2005.

In October 2006, WANO AC carried out the fourth LVNPS peers review as Level III, comparing the performance with the INPO and WANO guidelines. This time, LVNPS obtain its best results to this date, both in the number of opportunity areas as well as in the identified strengths. These improvement areas had an action plan assigned and have been considered in the current LVNPS Strategic Plan.

For the second half of 2008, the fifth evaluation of LVNPS as Level III will be carried out by WANO Atlanta Center (AC).

Regarding the findings and observations of the Independent Audit carried out by the TÜV Company from November 2000 to January 2001, as of December 2006 98% of the cases have been solved and closed, and the remaining 2% are issues that are solved in a permanent processes.

14.3 SAFETY ASSESSMENT, ACTIONS FOR ITS CONTINUOUS IMPROVEMENT

One of the activities in the Regulatory Body for continuous safety improvement is the follow up of issues that require special licensee attention. These issues have been established as regulatory requirements for both LVNPS units.

The status of these requirements follows:

1. Assessment of the fulfillment of ALARA objectives. LVNPS is in process of adapting its procedures and controls to fulfill 10 CFR Part 20, the last current revision, and with ICRP-26. See section 15.2 of this National Report.
2. Simulator fidelity and reliability requirements. CFE has a new simulator since August 2005. The CFE carried out two certification tests and CNSNS granted a preliminary approval of the simulator for retraining and initial training activities.
3. Development of a strategic plan for the definitive storage of radioactive wastes of low and medium level, and construction of a decontamination storage. CFE proposed a strategic plan to resolve this requirement and to provide an optional solution for temporary waste storage. This plan includes the construction of the Definitive Radioactive Waste Storage (ADDER). In the meantime, CFE has adopted an optional solution (temporary) consisting of the construction of the Re-Used Parts Collecting Center and Contaminated Oils Storage (CCAC), as well as the enlargement of the Temporary Wet Waste On- Site Storage (ATS). Regarding Decontamination Storage, CFE proposed a general description of construction project. Nevertheless, currently it has conditioned an area in the Radwaste Building.

4. Financial mechanisms to have sufficient economic resources for decommissioning. CFE shall analyze together with CNSNS the regulatory and technical part of the Preliminary Preventive Plan for LVNPS Units 1 & 2 decommissioning. See section 11.4 of this National Report.
5. External Radiological Emergency Plan. An integrated exercise was carried out in October 2006, covering 8 areas. CNSNS carried out the evaluation of this exercise and identified some deficiencies which are being solved by different task forces. See sections 16.2.2.2 and 16.4 of this National Report.
6. Alarm Reduction Program conclusion. CFE has resolved the majority of this concern by the application of preventive maintenance actions and with modifications to original design. CNSNS is evaluating this for possible closure of the issue. See section 12.2 of this National Report.
7. Environmental Qualification Maintenance. CFE is giving permanent attention to this concern under CNSNS follow up to actions taken by CFE to maintain environmental qualification in equipment. Deficiencies detected by CNSNS are now being resolved by CFE.
8. Quality List for the safety related equipment and components. This issue was resolved by CFE and CNSNS has followed up on the actions taken by CFE.
9. Verification of the operability of motor operated valves and local leak criterion for check valves. Operability of motor operated valves is continuously attended by CFE through the implementation of USNRC Generic Letter 96-05, and CNSNS has followed up on the actions taken by CFE. Regarding check valve leak criterion, the solution submitted by CFE has been evaluated as acceptable by CNSNS.
10. Implementation of Maintenance Rule. Maintenance Rule has been implemented and currently, after each evaluation cycle, CFE is writing an evaluation report of the cycle on the performance of systems under the scope of this Rule. CNSNS periodically verifies this activity
11. Preventive maintenance program and its modifications resulting from the activities during refueling outages. This issue is continuously attended by CFE since it is permanent.
12. Completion of administrative procedures implementation and operating procedure review. This issue was closed and CFE will continue attending to it on a biennial base.
13. Procedure development including the participation of the Reactor Engineering Group. This concern was resolved by CFE. CNSNS periodically inspects the adequate fulfillment of this requirement.
14. Configuration Control Maintenance This issue is continuously attended to by CFE and inspected by CNSNS.
15. Results and updating of the Water Chemistry Improvement Program. This issue is continuously attended to by CFE and periodic reports are submitted for CNSNS evaluation.
16. Loose Parts Monitoring System effectiveness analysis. CFE carried out and submitted for CNSNS evaluation, an analysis of this issue demonstrating that

this system was not necessary since there are other systems within the LVNPS reactor coolant pressure boundary more effective for the loose parts monitoring. CNSNS evaluated this analysis as acceptable, so this requirement is considered closed.

17. Individual Plant Examination completion including a Probabilistic Safety Analysis, Level 2. This issue was attended to by CFE and CNSNS evaluated it as acceptable. See section 14.5.2 of this National Report.
18. Creation of a Root Cause Analysis Team. CFE created within its organization a special team for the analysis of Event Reports in LVNPS, this way fulfilling the requirement.
19. Safety Culture elements strengthening and emphasizing conservative decision-making and strict observation of procedures. CFE continues with this plan in order to implement improvement actions, courses were given on conservative decision making. See section 10.2 of this National Report.
20. Reduction in adverse quality conditions. CFE implemented the "Corrective Action Program", which is similar to that used in several U.S. plants. The Regulatory Body performs a continuous follow up. See section 13.2.1 of this National Report.
21. Follow up of individual and collective radiation doses, personnel contamination, generation of solid dry waste, unplanned exposition to radiation during refueling outages. The effort by CFE in relation to these issues has resulted in an important decrease in collective dose. Nevertheless, the Regulatory Body continues with close follow up.

Condition No. 5 of the Commercial Operation License indicates that LVNPS must be reviewed periodically (Periodical Safety Review) against the most recent standards, norms and guides, both from the reactor's country of origin as well as from the International Atomic Energy Agency (IAEA). This is done in order to maintain LVNPS updated in the "regulatory stat-of-the-art". CNSNS originally established that this Periodic Revision would be every five years as of the beginning of commercial operation; however, the experience of the industry in such evaluations suggests a period of 10 years. Therefore, after the licensing process for the 5% power uprate of LVNPS, the operating licenses for both units of LVNPS establish that the Periodic Review is every 10 years.

For this reason, for LVNPS Unit1 CNSNS has a first Periodical Safety Review Report, which was delivered by CFE at the end of 1999 and basically followed the structure of the Final Safety Report or Second Stage Safety Report (ISSE). Regarding LVNPS Unit 2, CNSNS has requested that the Periodical Safety Review follow the guidelines in Safety Guide No. NS-G-2.10 of IAEA.

14.4 NEW FUEL DESIGNS FOR LVNPS

14.4.1 Historical Conformation of LVNPS Core

The information provided in this paragraph is additional and complementary to that provided in the last National Reports (Annex II).

At the start of the period considered, Unit 1 operated in Cycle 10 with a mixed core fuel GE9B (9x9) and GE12B (10X10). As of Cycle 11, the core was loaded with only GE12B (10X10) and this continues in Cycle 12 (end of the period considered).

Unit 2 operated in Cycle 7 with mixed core fuel GE9B (9X9) and GE12B (10X10), as of Cycle 8 it only had fuel GE12B (10X10) and at the end of the period considered Cycle 9 had the same type of fuel.

14.4.2 Problems Originated in LVNPS Core

A) Power Oscillations

Within the period of this National Report, power oscillations have not occurred at LVNPS.

In the period of the 6th refueling outage (May-June 2003) for Unit 2 at the beginning of Cycle 7, CFE implemented one of the solution options proposed by BWR Owners Group (Option III) consisting of a stability monitor. This system was tested at the start up and during Cycle 7 and Cycle 8 (June 2003-April 2006) to set the automatic set points that shut down the unit when power oscillations are present. These automatic trips were enabled during the 8th refueling outage (April-May 2006). For this reason, at the beginning of Cycle 9 (May 2006) the unit will be automatically shut down if these oscillations are present.

During the 10th refueling outage (May 2004) in Unit 1, the stability monitor was also installed (Option III) and tests were made at the start up and during Cycle 11 (May 2004-September 2005). In the course of the current cycle, Cycle 12 (October 2005-March 2007), the performance of the Oscillation Power Range Monitor (OPRM) is being monitored on a monthly basis in order to set its automatic trips, and will be enabled during the 12th refueling outage (March 2007).

B) Fuel Failures (Leakages)

Five fuel bundles with a failed fuel rod have been detected in LVNPS Unit 1 at the end of the considered period. Four of them GE9B(8x8) are stored in the spent fuel pool; the fifth bundle GE12(10X10) was reassembled, and is currently inside the reactor core and it is planned to be removed during the 12th refueling outage (March 2007). Reassembly consisted of changing the leaked rod for a new one; the fuel rod removed from this bundle has been stored in the spent fuel pool inside a special

container. At the end of December 2006, fuel with a small leak was detected and it shall be identified during the 12th refueling outage.

Six fuel bundles with some failed fuel rods have been detected in LVNPS Unit 2 at the end of the considered period. Two of them (GE6) are stored in the spent fuel pool. One of them was reassembled and reinserted into the reactor. The other three fuel bundles (GE9B) are stored in the spent fuel pool. During the 7th Refueling Outage (October 2004) a leaked bundle was detected, to be reassembled in July 2007 and loaded in the reactor during Cycle 10; the leaked rod in that bundle was removed in March 2006 and is in a special container.

In all the cases, a root-cause analysis was carried out, covering visual inspections, eddy current tests, ultrasonic tests, etc. The identified cause for the failed fuel rods is the intrusion of very small foreign materials to the primary circuit of the reactor core cooling water. A special program for foreign material intrusion control was put in place during maintenance and refueling outage activities.

14.5 PROBABILISTIC SAFETY ANALYSIS (PSA)

The scope of the Laguna Verde Nuclear Power Plant PSA Level 1 and 2 is the analysis of severe accident sequences, including only internally initiated events that could result in core damage, loss of containment integrity and fission product releases. Internal flooding is included, as part of the Individual Plant Examination requirements, as well.

Evaluation of externally initiated events (i.e. internal fires, high winds/tornado, transportation accidents, external floods and earthquakes) are not included in the PSA Level 1 and 2 for LVNPS. However, in the short term the Regulatory Body will formally request CFE to submit an IPEEE (Individual Plant Examination for External Events).

The main conclusion of PSA Level 1 and 2 for Laguna Verde Nuclear Power Station is that the largest contributions to core damage frequency are loss of offsite power accidents with different time durations.

Loss of coolant accidents outside containment contribute to the Large Early Release Frequency (LERF). These sequences are currently represented by the isolation failure between the primary system and low pressure systems (interfacing system LOCA). Its level of importance was reduced significantly by correcting a weakness in the design logic for opening injection valves of the Low Pressure Coolant Injection and Low Pressure Core Spray Systems (LPCI and LPCS).

The possibility of successful containment venting and the core cooling after containment failure have reduced the importance of the loss of long term heat removal accidents originally found to be important in WASH-1400.

The accident sequence with the highest contribution to core damage frequency is a loss of offsite power with failure of the Emergency Diesel Generator Division I, and subsequent failure of the High Pressure Core Spray System, failure of timely depressurization and failure of Reactor Core Isolation Cooling System (RCIC) due to battery consumption.

14.5.1 Probabilistic Safety Analysis Level 1

Since the PSA model was initially developed when the LVNPS Unit 1 started commercial operation, there was no operational experience to incorporate in the PSA model, so it was not possible to use plant specific data in the first PSA. However, once this study was approved by the CNSNS, LVNPS was requested to update the analysis, to incorporate those modifications to plant design and operation. Plant specific data for failed components, systems and initiating event frequencies are included.

Gathering of reliability / availability data since 1998 has had multiple uses. For example, the data collected to fulfill the requirement of Maintenance Rule (10 CFR 50.65) has been used in the PSA. The plant specific failure data was calculated using Bayesian Analysis to obtain the new failure rates of equipment and components as well as the frequency of initiating events.

PSA Level 1 uses the test intervals of the surveillances established in the Technical Specifications (ETO´s) in order to obtain the unavailabilities of equipments and components. Information from LVNPS Internal Operational Experience is used (including External Operational Experience) for the determination of frequency of initiating events.

New PSA models are being developed for the failure of isolation of the RCIC and RWCU with their respective logic. Also, the frequency and recovery of offsite power is being updated based on operational experience.

Since the implementation of periodic updating of the PSA, the intent is to update the event tree and fault tree models in order to represent the current design and operational characteristics of LVNPS, as well as, the incorporation of plant specific data for equipment and component failure, and initiating event frequencies. For this reason, there are variations in the contributions of the different types of scenarios summarized below:

CONTRIBUTION FROM EACH SCENARIO

SCENARIO	CONTRIBUTION
Total Loss of Alternate Current (SBO) Phase 2	38.00 %
Total Loss of Alternate Current (SBO) Phase 3	25.00 %
Total Loss of Alternate Current (SBO) Phase 1	17.00 %
Interfacing System LOCA (Outside the Containment)	0.10 %
Anticipated Transients Without SCRAM (ATWS)	8.00 %
Loss of BOP (Transients)	4.00 %
Total Loss of External Power with success of one Diesel Generator	1.90 %
Loss of Both DC Divisions	2.40 %
Loss of NSW	1.50 %
Loss of NCCW	1.50 %
Large LOCA	0.18 %
Intermediate LOCA	0.50 %

Results of the Level 1 PSA have shown that core damage frequency is $2.30X10^{-5}$ reactor-year, which is similar to that obtained by the international community for this type of reactor.

As examples of the safety improvements performed as a result of the PSA study, the following can be mentioned:

1. Training of plant personnel on diesel generator manual startup, as well as other recoveries from common failures of this equipment, and implementation and observance of a contingency plan for the recovery of external power.

2. Modification of the interlock for opening LPCI and LPCS injection valves, from a differential pressure signal through the valve to a reactor vessel low pressure signal, which decreases the impact of interfacing system LOCA sequences. It can be pointed out that this improvement has already been implemented at LVNPS under a previous evaluation and approval by CNSNS.

3. Development and installation of a Risk Monitor, which uses the PSA Level 1 model on EOOS software. This monitor is a supporting tool for Plant Configuration Control through a control of risk increases due to Planned or Corrective Maintenance and surveillances that cause the unavailability of the

function of significant safety systems. This activity is regulatory and is established in 10 CFR 50.65 paragraph (a)(4) of the Maintenance Rule.

In addition to these physical improvements, an extensive participation of operations, engineering, maintenance and training personnel in PSA tasks has taken place. This has resulted in the dissemination of PSA insights into key plant activities and procedures.

14.5.2 Probabilistic Safety Analysis Level 2

PSA Level 2 was developed initially as part of the Individual Plant Examination (IPE), and later an update of this study was required (Rev. 2) as part of the requirements of the modification to the original License for Commercial Operation (derived from an 5% increase in power).

The objective of the IPE was the determination of the source term and containment response in the event of a severe accident. This study has been used to determine the Large Early Release Frequency (LERF).

In order to evaluate the containment response during a severe accident, LVNPS containment was analyzed, showing several favorable design characteristics, such as its structural capacity, its specific volumetric capacity and its seismic design.

The MAAP Code was the main tool used for LVNPS Individual Plant Examination to model severe accident phenomenology occurring within the vessel and containment and to determine the off-site release of fission products.

From the PSA level 2, a release frequency value of 1.84 E-6, which must be recalculated using the updated PSA Level 1, corresponds to all containment failure modes; taking into account the magnitude of the release (high, medium, low and low-low and not relevant), and the time after containment failure (early, intermediate and late stage).

Results from PSA Level 2 Revision 2 show that the four release categories that contribute most are:

- Sequences with release of High magnitude in an Intermediate release time (H/I) with 58.2% contribution
- Sequences where Primary Containment remains Intact (I) with 19.2% contribution
- Sequences with release of High magnitude in a Late release time (H/L) with 8.9% contribution
- Sequences with Low release in an Intermediate release time (L/I) with 9.0% contribution

These release categories is defined below:

- Releases of High magnitude (H): more than 10% of the initial inventory of fission products, measured as a percentage of the Cesium-Iodine
- Releases of Low magnitude (L): a value lower than 1% of the initial inventory of fission products
- Intermediate release time (I): the beginning of the first release occurs between 6 and 24 hours
- Late release time (L): the first liberation occurs after 24 hours

Regarding the programs to obtain a specific PSA for each LVNPS reactor, differences between the LVNPS units have been identified and submitted to CNSNS, who carried out a detailed review of them. These differences were incorporated into the LVNPS Unit 1 model in order to generate a specific PSA for Unit 2, which was reviewed and approved by CNSNS.

There are some efforts in CNSNS to analyze the risk associated with LVNPS operation in low power and shutdown conditions. This CNSNS effort is due to operational experience which has demonstrated that in those conditions, risk increase is significant.

Finally, a regulatory requirement has been established for updating the PSA model for LVNPS Units 1 and 2, within six months following the conclusion of the corresponding refueling outage.

14.5.3 Application of Risk Informed Regulation

Based on the knowledge and results of LVNPS 1 & 2 Individual Plant Examination (IPE) and the application of Maintenance Rule (10 CFR 50.65), the implementation of Risk Informed Regulation continues. The scope of the application of the Maintenance Rule (systems and structures covered by the Rule) was determined by using risk importance defined by the Probabilistic Safety Analysis (PSA) and measures of Risk Reduction Worth (RRW) and Risk Achievement Worth (RAW).

Plant Configuration Control has been implemented in the LVNPS. This means the control of risk increments caused by important to safety systems that are put out of service, due to planned or corrective maintenance, or surveillances. This Risk Management, required by the paragraph (a)(4) of 10 CFR 50.65, is carried out by means of a computerized system (Risk Monitor), and is based on the PSA Level 1. This Risk Monitor is used by operators and for planning activities, as well. Currently, the Monitor is periodically reviewed by the Regulatory Body.

The Risk Monitor is used for risk calculation during plant operation at nominal power. For shutdown conditions, the determination of configurations is applied based on

Defense in Depth analysis following the guidelines of the Nuclear Energy Institute (NEI) from the USA.

During this period, CNSNS has established the policy on PSA use in regulatory activities. It consists of promoting use of a deterministic and probabilistic analysis together in order to support the integral decision making in several operation and design activities of a nuclear installation. CNSNS has developed the Regulatory Guides GR SN-01 “License Base Changes” and GR SN-02 “Technical Specifications Changes”, a part of his efforts to adopt the Risk Informed Regulation.

CFE is carrying out two applications as a first attempt to implement this regulation; one of them is using an “Alternate method for spent fuel pool cooling” during refueling outage and the other application is a modification to the Technical Specification regarding the “Instrumentation for isolation action”, which the Regulatory Body has under evaluation.

On the other hand, the Regulatory Body developed the Risk Based Inspection Guides, as an additional tool for its inspectors to improve inspection activities. This results in an optimization of resources, an improvement in the planning of activities and a reorientation of the inspection efforts. These Guides are based on NUREG/CR-5006 “PRA Applications Program for Inspection at Oconee Unit 3” and contain a series of tables organized to a system and component level, ranked by importance to risk reduction in LVNPS.

CNSNS application of Risk Based Inspection Guides has been applied to identify risk significant components and prioritize activities during normal operation and refueling outage inspections at LVNPS. During normal plant operation inspections, these guides have been applied to identify maintenance, test and surveillance activities, report and document reviews of the plant systems, of the components and of the equipment that contribute most to plant risk. Likewise, during refueling outages, these guides have been used to identify components and equipment that contribute most to the unavailability of systems important to core melt frequency, in order to prioritize activities valve leak tests, preventive and corrective maintenance, implementation of modification packages, surveillance tests by Technical Specifications and snubbers inspection.

Furthermore, the guides have helped CNSNS in saving inspection efforts at LVNPS. One example is the amount of savings in effort during the “Risk based inspection of LVNPS Unit 2 systems”, carried out in November 2004 are showed in Figure 14-4.

14.6 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

14.6.1 Achievements and Changes in Safety Related Activities

The Regulatory Body has carried out substantial activities (evaluation and inspection) to ensure that LVNPS operation does not represent a risk to public health and safety, and emphasizes more relevant issues. For this, the following achievement is highlighted:

- The Risk Based Inspection Guides have helped in saving inspection efforts. (See section 14.5.3 of this National Report).

During 2006, WANO acknowledged LVNPS as the best performing plant in the world outside the United States during the year 2005.

As a result of the LVNPS Probabilistic Safety Analysis, the following improvements have been identified (See section 14.5 of this National Report):

- Reduction in the frequency of interfacing system LOCA sequences , due to the modification of the actuation logic of the injection valve of the Low Pressure ECCS
- Development and implementation of the Risk Monitor
- Training of plant personnel on diesel generator manual startup and observance of contingency plan for external power recovery

Nuclear instrumentation of the LVNPS has been updated. In particular, the installation of a thermohydraulic instability monitor. Unit 1 is currently in the testing phase and in the Unit 2 automatic trips were installed in the 8th Refueling Outage.

14.6.2 Future safety related activities and foreseen or proposed programs

In the period covered by this National Report and that corresponding to the next report:

The Regulatory Body will continue:

- Adoption and adaptation of USNRC Reactor Oversight Process and application of Inspection Guides using risk information

Laguna Verde Nuclear Power Station:

- In October 2006, the fourth peer review was made by WANO Atlanta Center; the following revision will be made halfway through 2008.

- Unit 1 analogical instrumentation associated with the APRM's will be replaced by instrumentation identical to that implemented in the LVNPS Unit 2.

- In December 2008, WANO will carry out the fifth revision of LVNPS Level II.

- In the 12th Unit 1 Refueling Outage, the oscillations monitor will begin functioning, which shall immediately shut down the unit if any oscillations are present.

14.6.3 Safety Concerns and Foreseen Actions

Safety evaluation and verification activities by external and internal organizations to the LVNPS, have not detected any safety issue of concern, thus implementation of any corrective or preventive action is not required.

14.7 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

As described in this article, the National Law and regulations adopted and imposed on LVNPS have provided appropriate means for detailed and systematic safety assessment by the Regulatory Body. Results of these assessments allowed the issuance of the corresponding construction and pre-operational test permits and later, the granting of LVNPS-1 & 2 operating licenses.

Furthermore, the Operation License requires the execution of periodic safety reviews to enforce LVNPS updating in light of operational experience and any other new and significant information on safety matters, which may arise during LVNPS' lifetime.

Also, In-Service Inspection and Test programs for structures and components as well as the Maintenance of the Environmental Qualification of mechanical, electrical and instrumentation equipment important to safety, verify that the physical condition of nuclear installations and their operation is maintained in accordance with its design, applicable national requirements as well as limits and conditions specified in the Technical Specifications for Operation.

Based on the information presented in this National Report it can be concluded that obligations of the Article 14 of the CSN are satisfied.

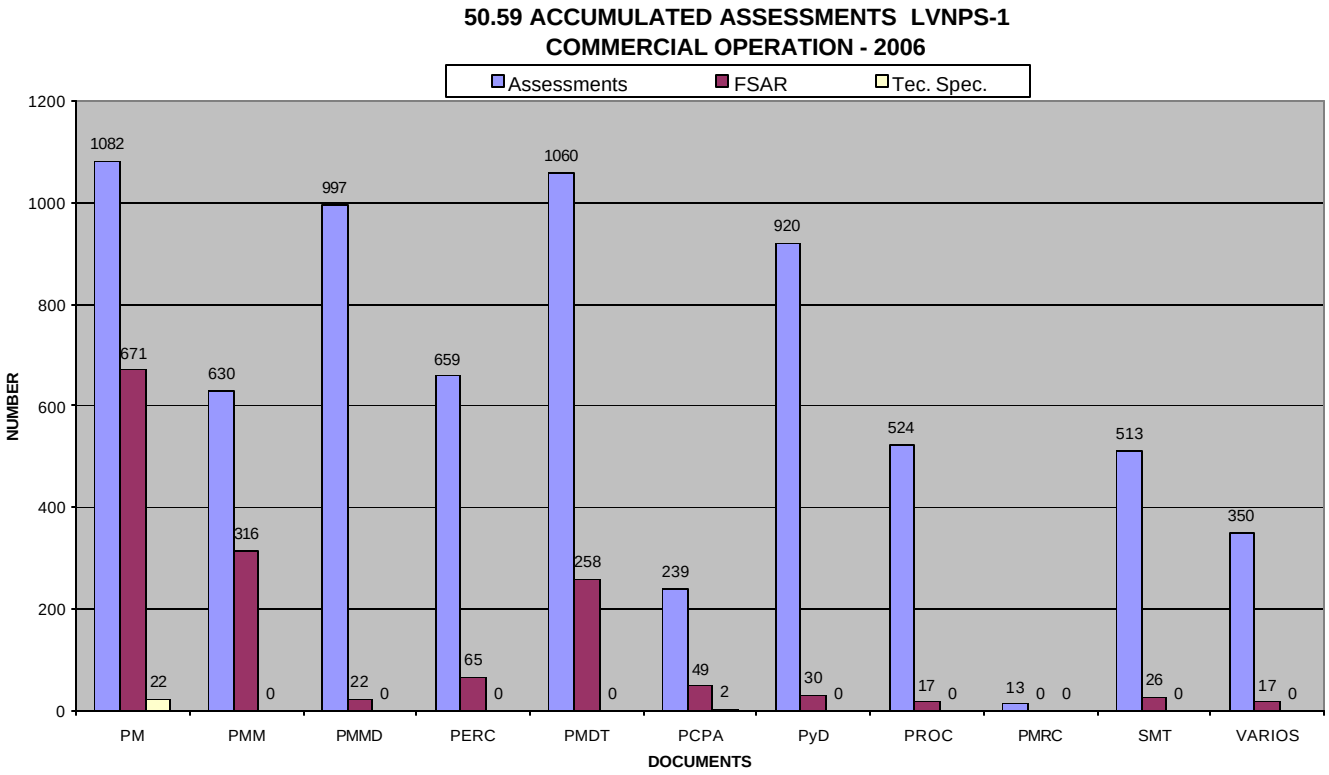


FIGURE 14-1

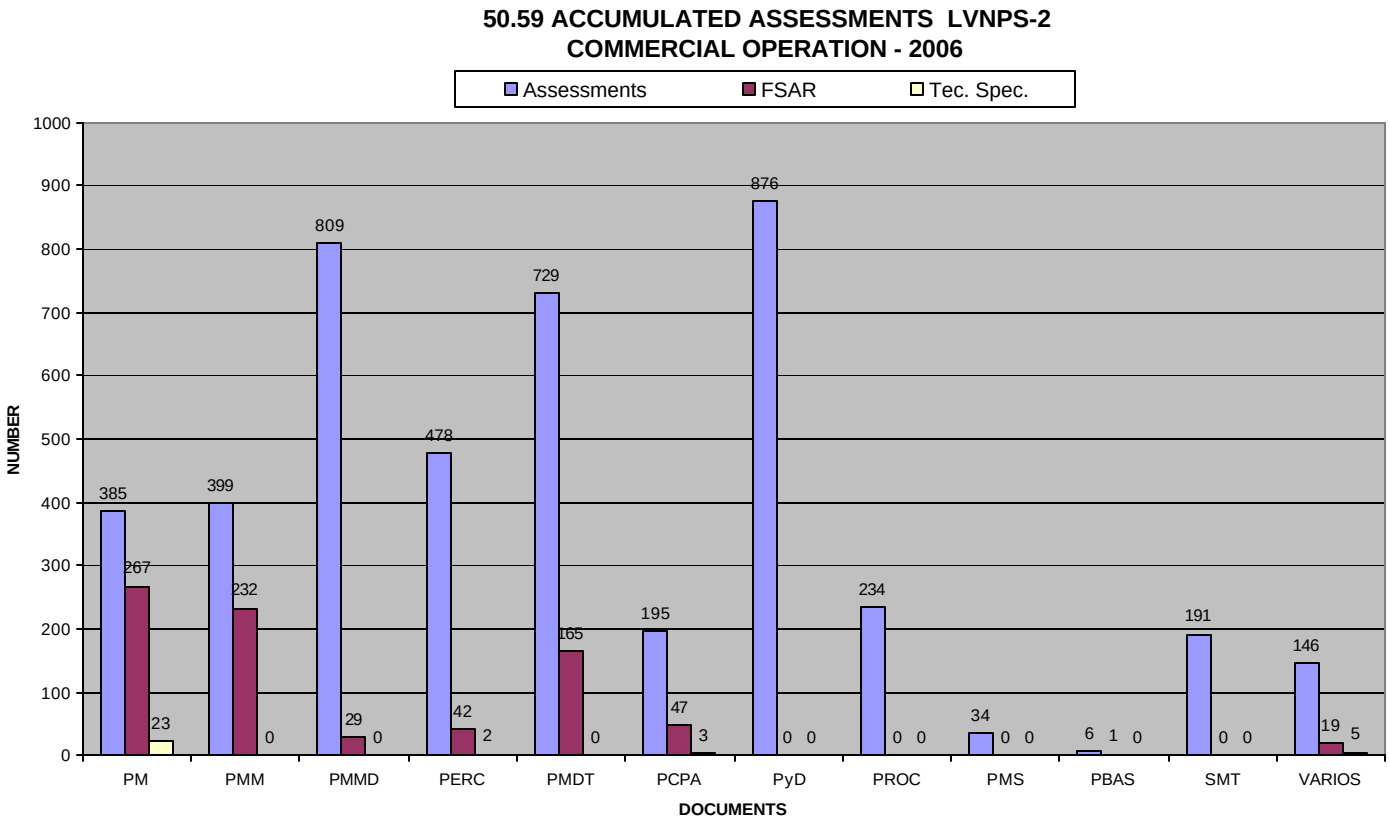


FIGURE 14-2

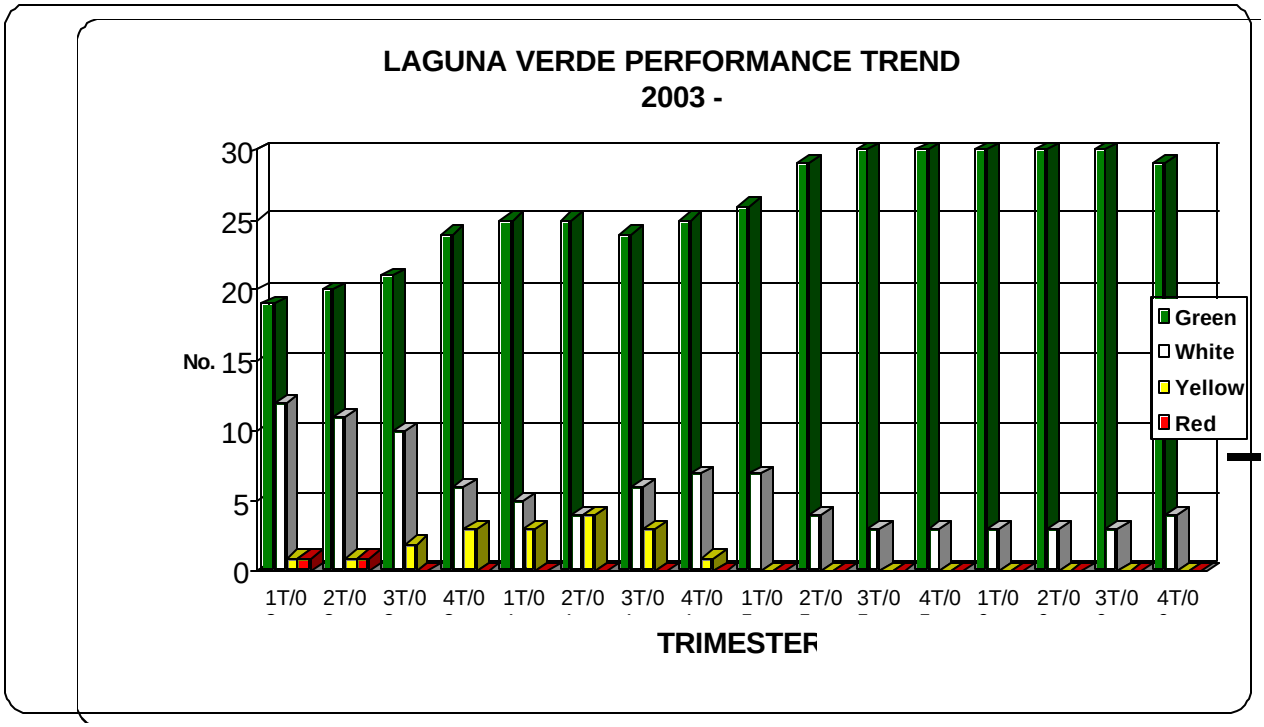


FIGURE 14-3

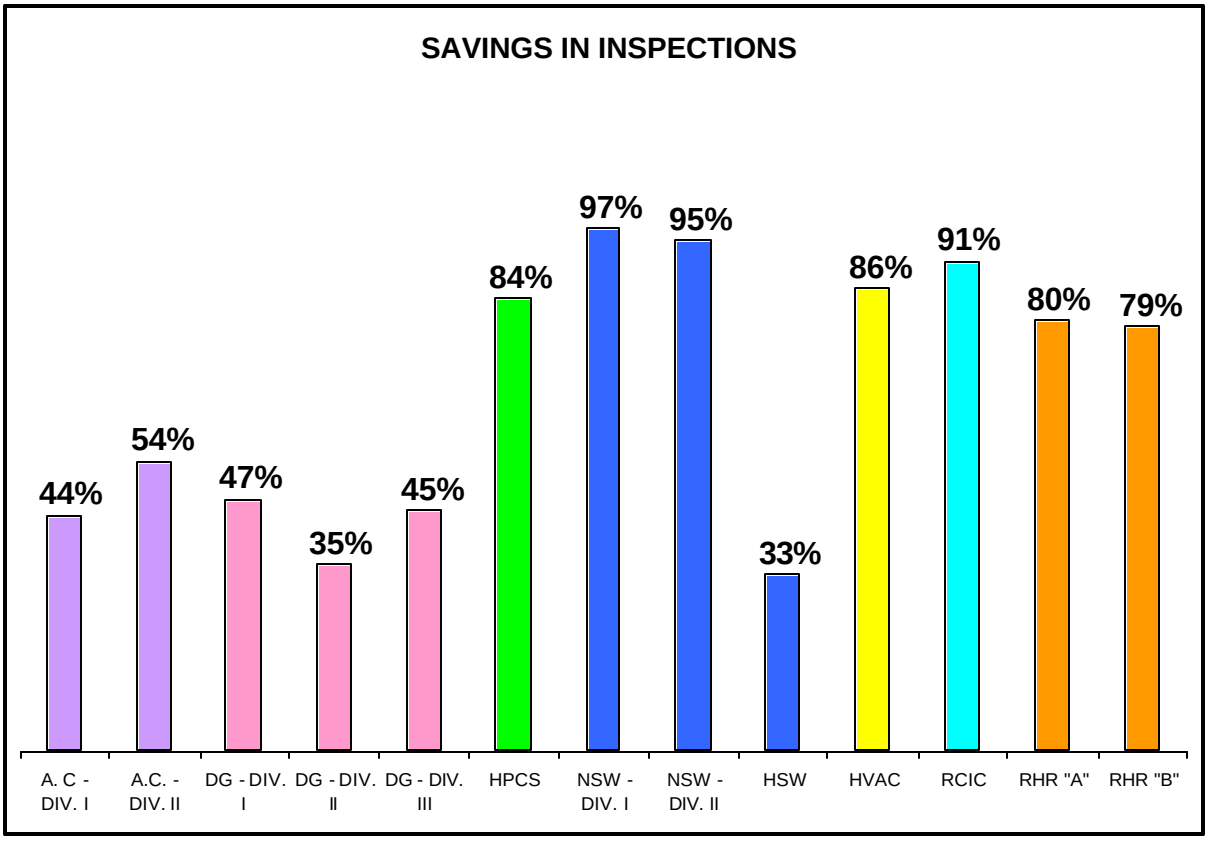


FIGURE 14-4

ARTICLE 15. RADIATION PROTECTION

15.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

15.2 INTRODUCTION

Since the construction of LVNPS was decided, due to the lack of national regulations in that moment, it was required that this facility comply with regulations of the country that supplied the reactor. This implied that compliance with the version of the 10 CFR 20 effective at that moment in the USA was necessary, however, at that time this code was not consistent with ICRP-26. Later on, in 1988 the General Regulation on Radiation Safety was issued, which is consistent with the ICRP-26 and the current 10 CFR 20.

For this reason, in the period that comprises the present National Report, LVNPS is in the process of modifying its procedures and controls to comply with this regulation and has adopted as an administrative limit, a value compatible with ICRP-60 of 20 mSv (TEDE) by which it has abided since the year 2003.

15.3 RADIATION PROTECTION AT LVNPS

15.3.1 Radiation Protection Program

In order to fulfill ALARA criteria in all activities carried out by LVNPS personnel, the plant has a specific group, the “Radiation Analysis Group”, lead by the Radiation Protection Organization Head, together with a team of analysts of that department. Their function is to analyze, evaluate, control and optimize radiation exposure of personnel in their respective activities.

A historical summary of the collective dose for both units of LVNPS and the individual exposure average and personnel maximum values are shown in Table 15.1 and Figures 15.1.a/b and 15.2, for LVNPS Unit 1 and 2, respectively.

As for individual dose, while the Total Effective Dose Equivalent (TEDE) imposed by the Regulatory Body according to references stated in section 15.2 of this National Report is 50 mSv/year, since 2003 LVNPS has adopted an administrative limit of 20 mSv/year. The fulfillment of this limit can also be observed in Table 15.1.

TABLE 15.1

COLLECTIVE AND INDIVIDUAL RADIATION DOSE SUMMARY FOR WORKERS

Year	Annual Collective Dose (person Sv)		Annual Dose Per MW (person Sv/MW)		Individual Dose (mSv)	
	Unit 1	Unit 2	Unit 1	Unit 2	Average	High (max)
1990	1.34435	N/A	0.0466	N/A	1.1610	10.07
1991	5.14748	N/A	0.0106	N/A	2.0520	N/A
1992	5.44015	N/A	0.0122	N/A	2.4510	20.30
1993	1.96603	N/A	0.0035	N/A	1.7460	20.59
1994	6.02126	N/A	0.0125	N/A	2.4020	19.92
1995	4.93073	0.99740	0.0100	0.0025	2.7510	24.75
1996	12.51806	3.63899	0.0288	0.0078	5.4270	37.97
1997	1.94839	2.55289	0.0031	0.0045	2.1140	18.76
1998	5.95528	3.58329	0.0113	0.0067	3.3650	31.72
1999	6.20219	1.13318	0.0117	0.0019	2.1700	21.54
2000	1.33760	4.31730	0.0025	0.0110	2.5800	23.02
2001	3.97322	2.60831	0.0080	0.0052	2.9251	26.75
2002	2.89238	0.54009	0.0058	0.0009	2.1062	17.95
2003	0.66160	3.15420	0.0010	0.0057	1.9926	18.52
2004	3.59474	3.47921	0.00728	0.00626	1.8064	21.72
2005	2.78328	0.57476	0.00475	0.00089	1.0420	14.59
2006	0.65405	2.30862	0.00101	0.00389	0.8612	12.43
TOTAL	**67.37079**	**28.88824**				

In addition to what is shown in Table 15.1 above, it should be mentioned that CFE, upon reviewing dosimetry results from September 2005, found that a contractor that had carried out industrial radiography work, had obtained 78.10 mSv, which exceeds the Annual Limit of 50 mSv Dose. The information collected indicates that this dose was received in an installation inside LVNPS, but is external to the Restricted Area, from a source that is property of the contractor. To this respect, CNSNS performed an inspection to investigate the facts and imposed requirements to CFE on: Radiation

Protection, External Sources to LVNPS, declaration of areas and shield of the installation where the irradiation occurred.

15.3.1.1 Collective Dose Reduction

As observed in Figure 15.2, the trend towards collective dose reduction in LVNPS continues, despite the peak of high collective dose in 2004. This occurred because it was a year with two refueling outages and various significant modifications, many of them in high radiation areas.

In all of LVNPS commercial operation, 2006 has been the year with the lowest collective dose (1.48 Person-Sv). The year 2007 will have two refueling outages, which will reflect an increase in the annual average collective dose with respect to 2005 and 2006; even then, the expected collective dose for 2007 (on the order 1.9 Person-Sv) shall be considerably less than that obtained historically in years with two refueling outages.

Figure 15.2 also shows that the forecasted collective dose for 2008 and 2009 will continue decreasing. By 2009, for example, an average collective dose per unit is expected to be on the order of 1.06 Sv-Person.

The radioactive source term reflected by BWR Radiation Level Assessment and Control Points (BRAC) indexes (average measurements of contact in mR/h, up stream and down stream of the recirculation loop pumps) have also decreased (Figure 15.3). For 2006, BRAC indexes for LVNPS Units 1 and 2 were in the second and first quartile, respectively, of North America's BWR reactors, according to benchmarking information provided by EPRI.

Implemented Strategies

Strategies observed in the period of this report, for collective dose reduction of LVNPS, can be summarized as follows:

1. Refueling duration reduction: typically on the order of 60 days, to less than 30 days.
2. Personnel technical capacity increase: this has drastically reduced the re-work rate.
3. Improvement of work planning and follow up.
4. Greater consciousness about teamwork.
5. Increase of supervision in the field.
6. Creation of a high level permanent committee to make decisions about those actions or processes that could cause the dose goals to be exceeded.
7. Foment in personnel the culture for using human performance tools

8. Increased perception on all levels of the need to reduce dose ("Every millirem counts")

Future Strategies

The strategies for the subsequent reduction in collective dose projected for 2007-2010 are based on the following measures:

1. Reduction in the collective dose thresholds to implement for ALARA work planning, from 10 to 5 Person- mSv.
2. Implementation of a simplified ALARA planning with an estimated collective dose between 1 and 5 Person-mSv.
3. Development of a campaign to push the sense of owning the radiation dose goal, in the technical areas of the organization, and at all levels.
4. Analysis of additional measures to be taken (Gap analysis) to detect and implement the measures necessary to reach the end of 2010 with an annualized collective dose per cycle (last 18 months including the refueling outage) of less than 1.2 Person-Sv. Some examples of these measures are presented below:
    I. Vapor release causal reduction
    II. Dose reduction by In-Service Inspections within the primary containment through the application of Risk Informed Analysis.
    III. Installation of vertical pumps for the Reactor Water Purifying System.
    IV. Installation of permanent shield in several sections of the plant.
    V. Installation of closed circuit televisions for distance monitoring of activities.
    VI. Adaptation of workshops for control rod drives (CRDs) in order to reduce time and dose.
    VII. Workshop construction with updated technology for the secretion of contaminated waste and decontamination of equipment and tools.
    VIII. Installation of permanent scaffolds.
    IX. Chemical decontamination.
    X. Optimization of Operation, Maintenance and Radiation Protection Routines.

15.3.2 Environmental Radiation Impact

Since LVNPS pre-operational stage (9 or 12 years before LVNPS commercial operation) information related to environmental radiation monitoring has been collected. This information has been obtained from monitoring and sampling systems of LVNPS Environmental Engineering Laboratory. The historical results of this direct environmental monitoring can be observed in Figures 15.4 and 15.5 noting that levels remain on the same order that existed in the pre-operational stage. As a reference

detection of events not related to LVNPS occurred during this stage and contributed to background increase.

Regarding the radiation impact to the general population, which is calculated from LVNPS effluents according to the models established by LVNPS Technical Specifications, in all cases the result is a small fraction of the corresponding limits as can be noticed in the following figures:

Figure 15.6.- Annual Liquid Releases Historical Data (LVNPS Units 1 and 2)
Figure 15.7.- Annual Gaseous Releases Historical Data (LVNPS Unit 1) - Noble Gases
Figure 15.8.- Annual Gaseous Releases Historical Data (LVNPS Unit 2) - Noble Gases
Figure 15.9.- Annual Gaseous Releases Historical Data (LVNPS Unit 1) - Tritium, Particles and Iodine
Figure 15.10.- Annual Gaseous Releases Historical Data (LVNPS Unit 2) - Tritium, Particles and Iodine

As shown in Figure 15.6, since 1996 the annual liquid release doses have diminished considerably mainly due to an improvement in the management of reuse of water, and in this way reducing liquid releases.

Figures 15.7 to 15.10 show a remarkable reduction trend in population dose from gaseous effluents since 1996.

15.3.2.1 Environmental Radiation Surveillance Program at LVNPS

LVNPS has an Environmental Radiation Surveillance Program that ensures a permanent continuous surveillance of the impact to the environment during normal operation: Some of the more relevant information about the Environmental Surveillance follows:

a) Atmospheric Releases
- External radiation, air — 32 sampling stations
- Inhalation, air — 16 sampling stations
- Radiation deposition on soil, food chain — 18 sampling stations

b) Liquid Releases
- Sea water at the discharge channel, marine biota, invertebrates, crabs, sargasso, marine sediment and beach sand sediment — 21 sampling stations

- Fresh underground water 3 sampling stations

The conclusions are the following:

- The limit concentrations established in the LVNPS Technical Specifications have never been exceeded by any sample or by any average value.
- Since the limit concentrations were not exceeded and the exposures measured using TLD remained under the preoperational values, it can be stated that no member of the general public exceeded the limits for the public due to emissions from the plant.
- The total beta activity detected during 2006 shows the same pattern as in previous years. Since 1978, the variations observed to date are on the same order of the variations during the previous years.
- The results of the Environmental Surveillance Program demonstrate that the population living in the neighborhood of the plant does not increase their radiation doses due to the operation of Laguna Verde, or at least such increase is not perceptible despite the very low detection limits reached in 2006.
- The only artificial radionuclides that have been present with a relatively high frequency in the samples are Sr-90 and Cs-137. However, these radionuclides have been present in the environment of Laguna Verde site even before the startup of the plant, and were originated from nuclear weapons tests having reached Laguna Verde latitude through "fallout". So, their presence is not due to the operation of Laguna Verde, and they show a tendency to diminish slowly due to its half-life.
- During 2004-2006 some radionuclides were detected due to the operation of LVNPS, they are Zn-65, Mn-54 and Co-60 in very small concentrations.

15.4 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

15.4.1 Achievements and Changes in Safety Related Activities

The Radiation Protection Program of LVNPS has provided the following results:

- Collective dose has a clear reduction trend. The years 2005 and 2006 have been the years with the lowest collective dose in the commercial operation stage of LVNPS.
- BRAC indexes of LVNPS show the degree of success of the radioactive source term reduction campaign, so LVNPS is one of the best BWR nuclear stations in North America in this regard.

- The shortening of refueling outages and a drastic reduction in re-works have been influencing factors in the collective dose reduction experienced by LVNPS during the years 2005 and 2006, in addition to the positive influence on plant productivity.
- Better planning, team work and in depth field supervision have been key in improving radiation protection indicators.

The Environmental Radiation Surveillance Program has provided the following results:

- Annual doses to population for liquid releases continue showing a reduction trend due to the enhancement of administration of reuse water
- The reduction trend in dose to population due to gaseous effluents continues.

On the other hand, in 2002 the review process of the General Regulation on Radiation Safety initiated. The objective was to make it consistent with IAEA Safety Collection document No. 115 “International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources”. This activity continued during this period.

15.4.2 Future safety related activities and foreseen or proposed programs

Within the period covered by this National Report and that corresponding to the next National Report, the foreseen activities by CFE at LVNPS expected to have a positive impact on its Radiation Detection Program are the following:

- ALARA work plans for lower limits: from 5 mSv-Person for total ALARA planning to 1 person-mSv for simplified ALARA planning. With this measure, ALARA work planning will cover a greater work spectrum with the consequent collective dose reduction.
- Implementation of a campaign to instill a sense of ownership about radiation dose limits by all personnel, which will include participation in all technical areas of LVNPS, under the statement “Each millirem counts”.
- Gap Analysis and steps to be taken to reduce the collective dose even more, at levels compatible with the goals established for the industry (WANO) by 2010.
- Volume reduction of compactable solid waste (super-compacting) and non compacting, mainly metals, through selective decontamination.

The Regulatory Body will continue with the revision of the current General Regulation on Radiation Safety and will begin developing a Mexican Official Standard for temporary storage of radioactive wastes.

15.5 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

The information presented in this Article shows that except for the case of a contractor of LVNPS who exceeded the Annual Dose Limit with a source that is not CFE property, no occupationally exposed personnel has exceeded the specified regulatory limits and that radioactive material releases and the resulting doses have remained below the corresponding regulatory limits.

Therefore, based on the information presented in this National Report, it can be concluded that the obligations of the Article 15 of the CSN are satisfied.

FIGURE 15.1.a
COLLECTIVE ANNUAL DOSE HISTORICAL DATA (LVNPS UNIT 1)
JANUARY 1989 - DECEMBER 2006

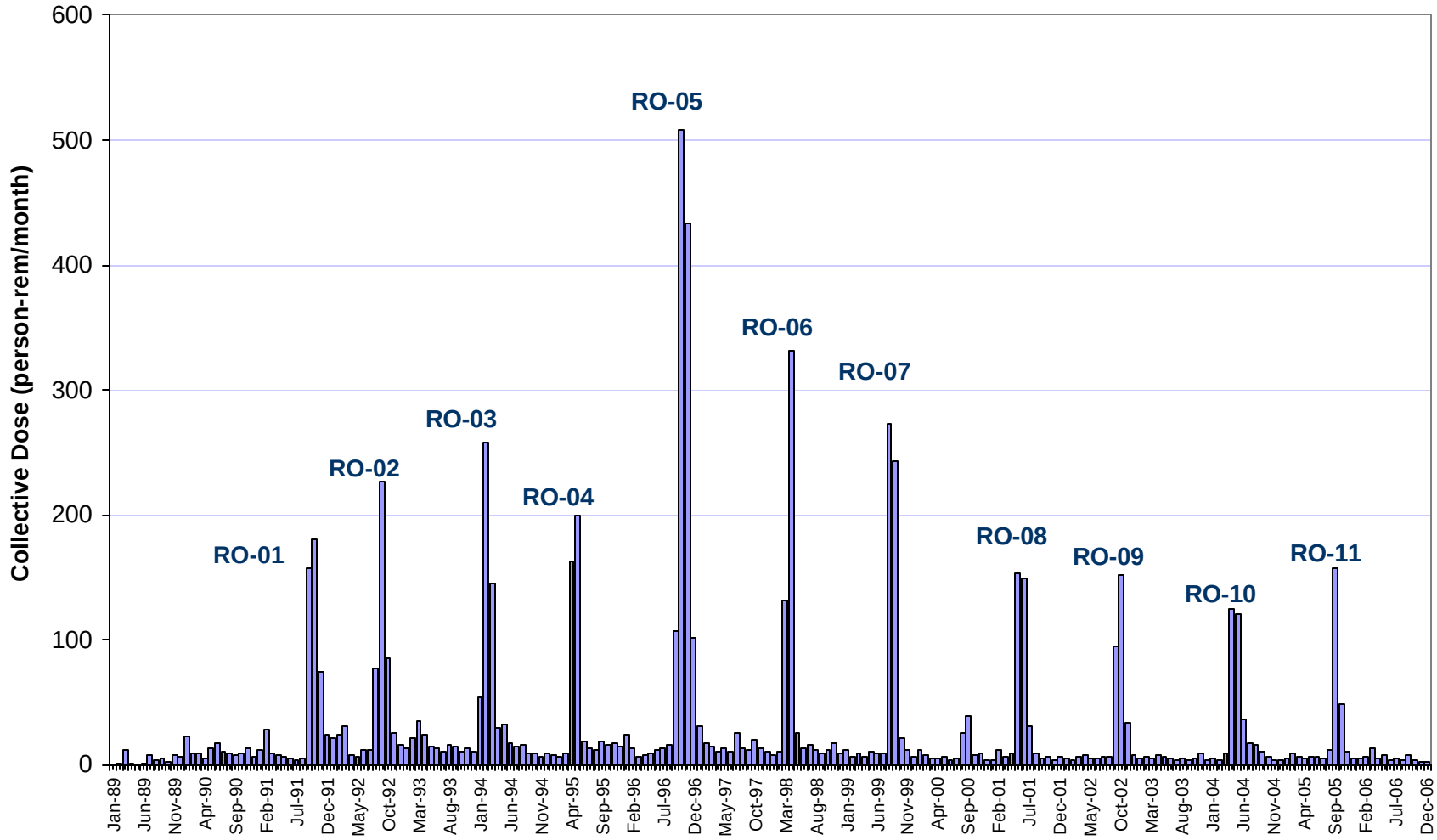


FIGURE 15.1.b
COLLECTIVE ANNUAL DOSE HISTORICAL DATA (LVNPS UNIT 2)
JANUARY 1995 - DECEMBER 2006

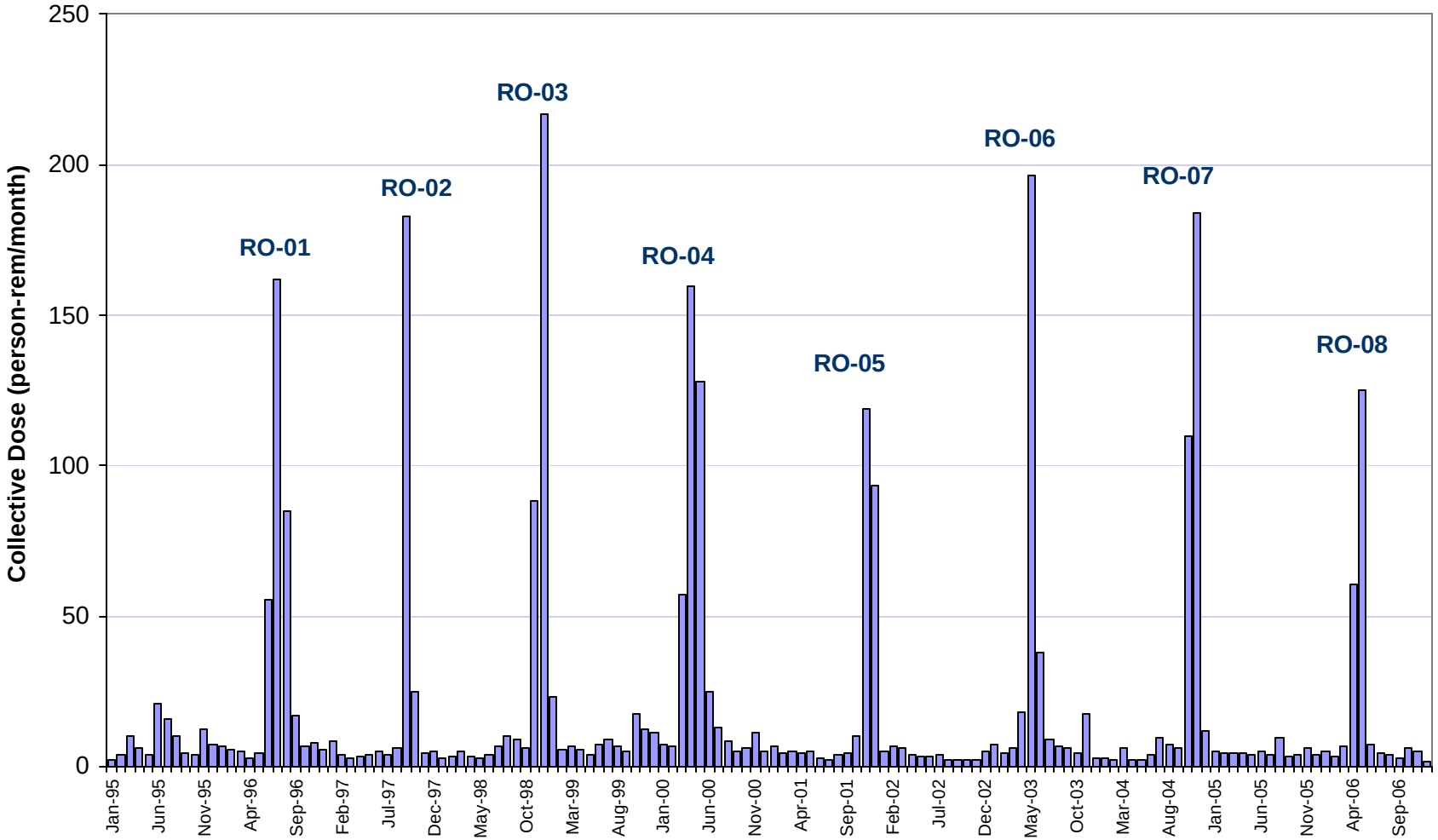


Fig. 15.2
Laguna Verde NPS:
Collective Dose Evolution

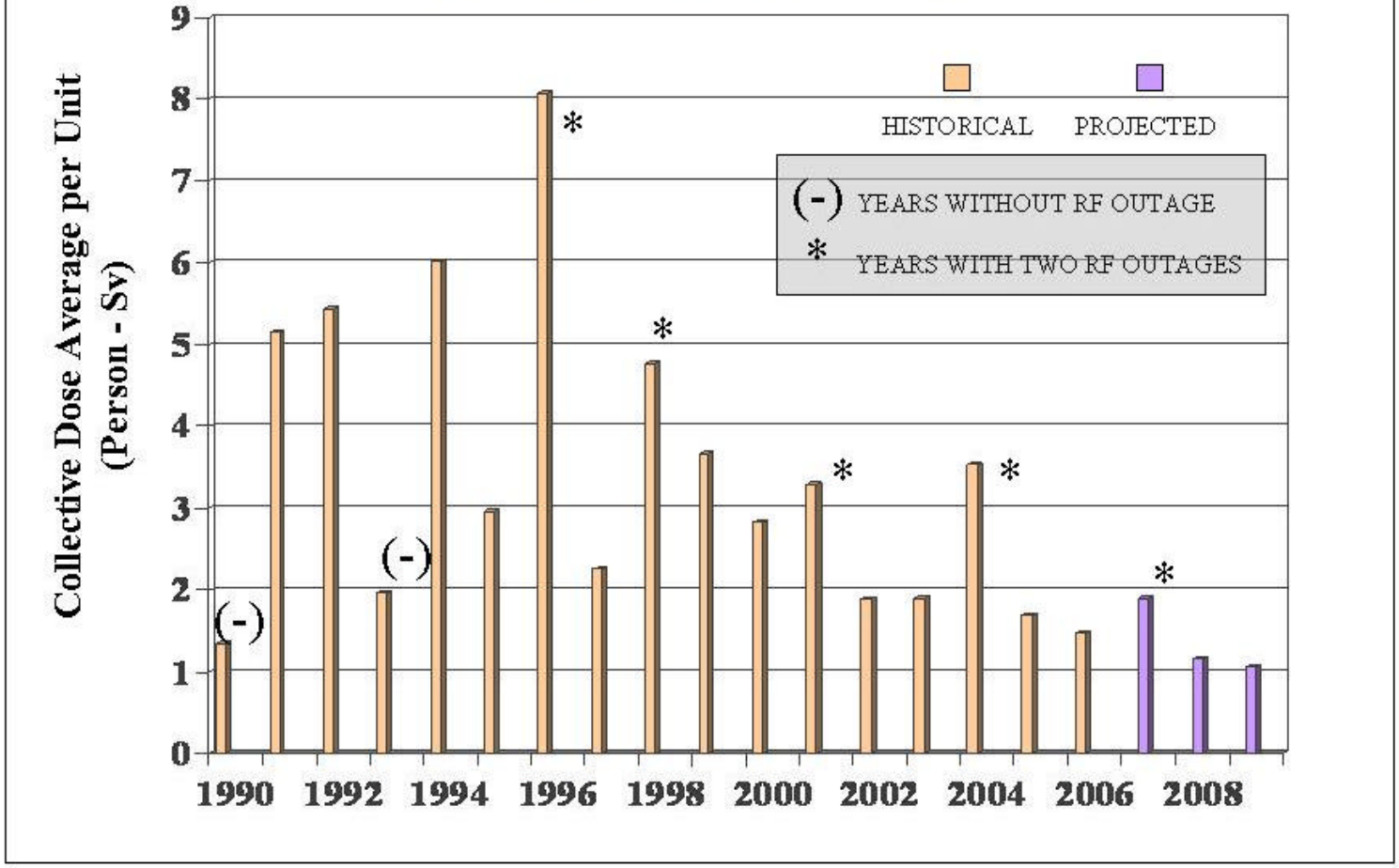


Fig. 15.3.a
LVNPS: BRAC Index History, Unit 1 (mR/h)

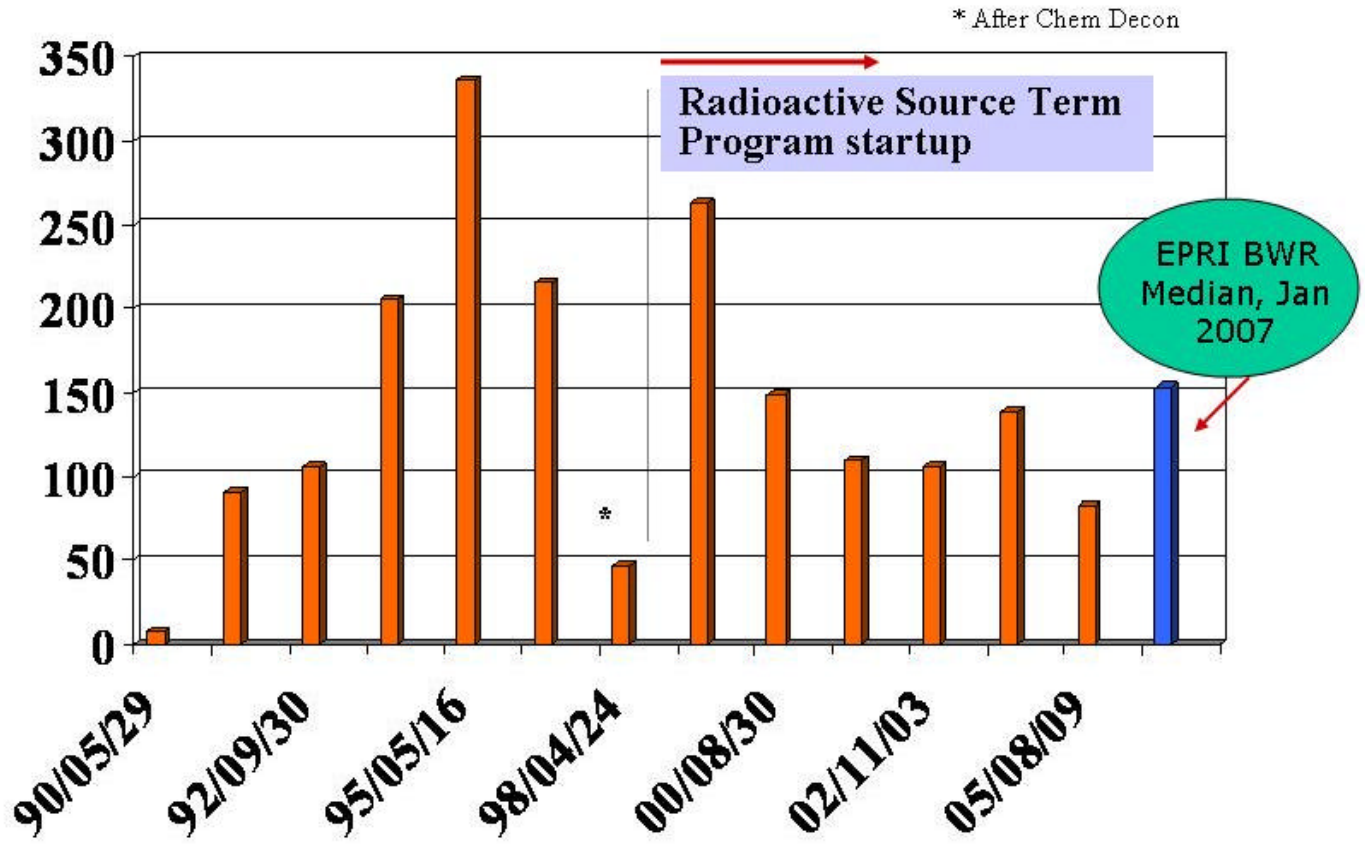


Fig. 15.3.b
LVNPS: BRAC Index History, Unit 2 (mR/h)

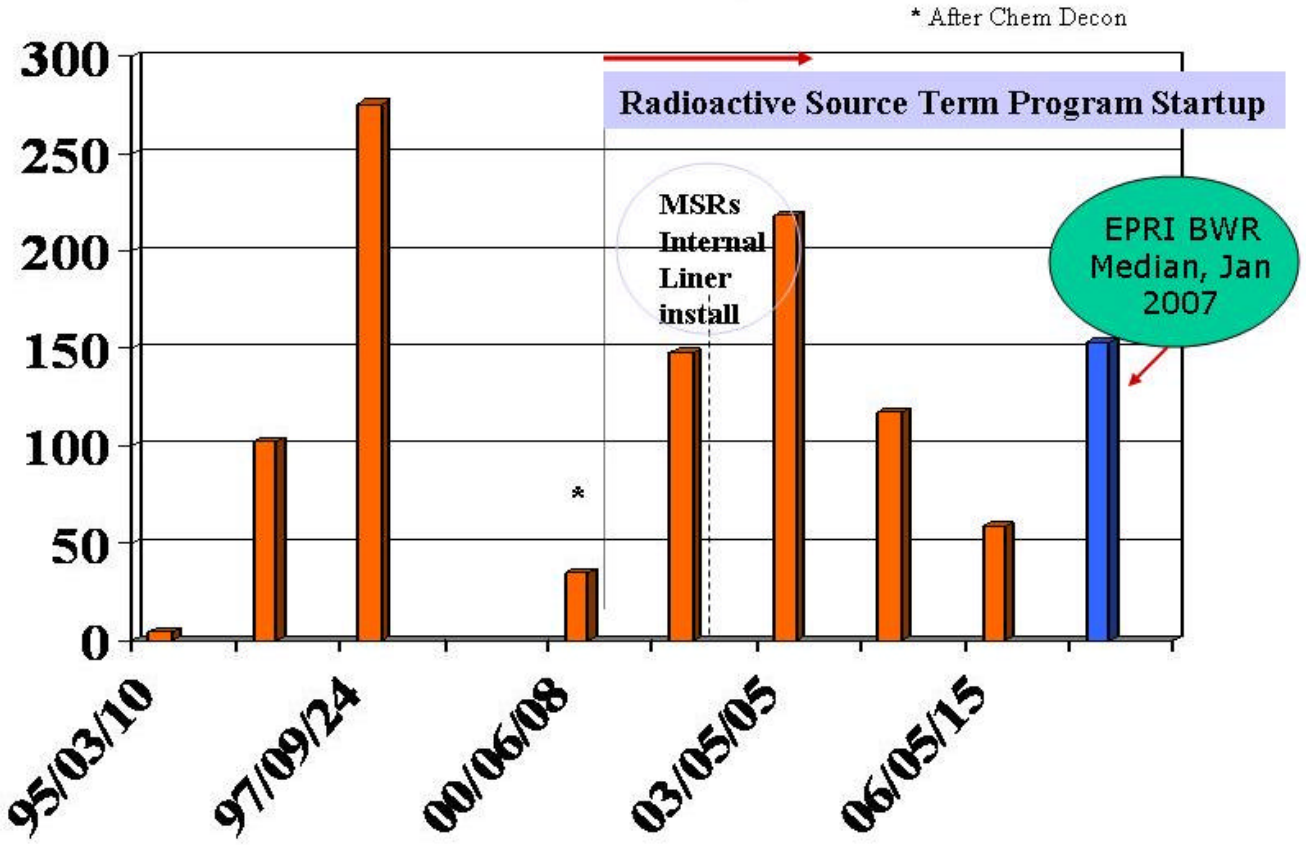


Figure 15.4

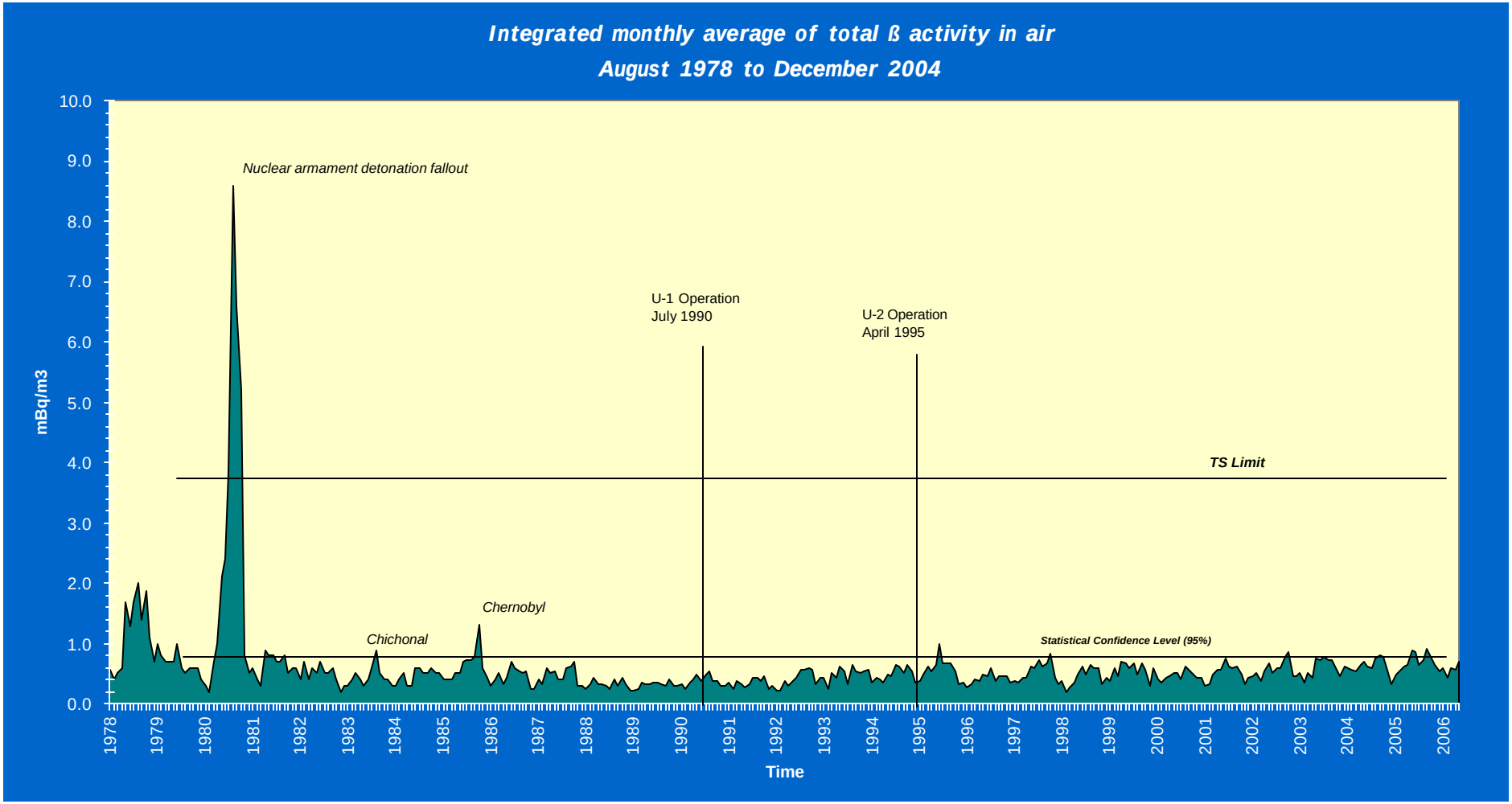

Integrated monthly average of total ß activity in air
August 1978 to December 2004
mBq/m3
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Nuclear armament detonation fallout
U-1 Operation
July 1990
U-2 Operation
April 1995
TS Limit
Chichonal
Chernobyl
Statistical Confidence Level (95%)
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Time

Figure 15.5

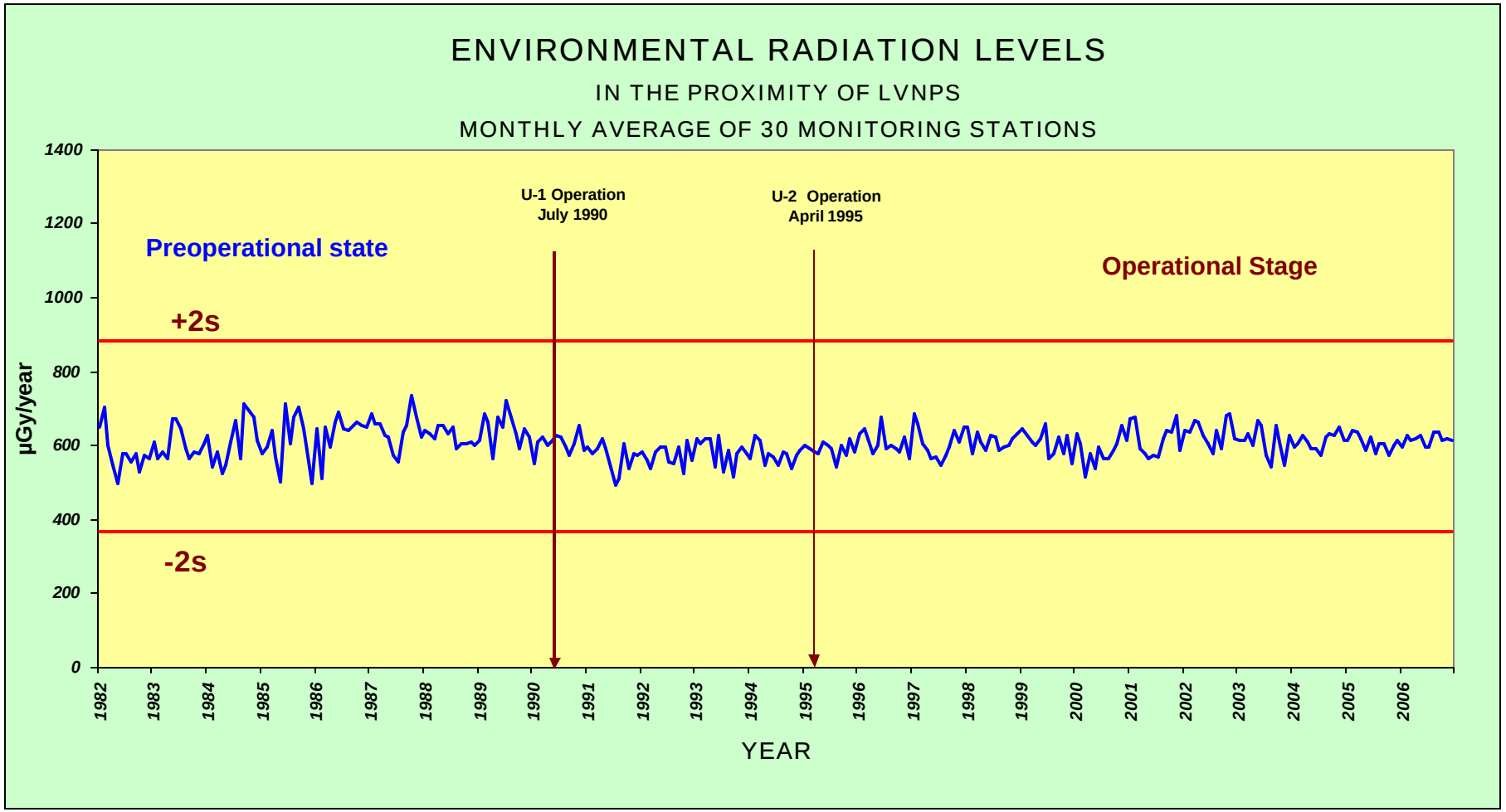

ENVIRONMENTAL RADIATION LEVELS
IN THE PROXIMITY OF LVNPS
MONTHLY AVERAGE OF 30 MONITORING STATIONS
µGy/year
1400
1200
1000
800
600
400
200
0
U-1 Operation
July 1990
U-2 Operation
April 1995
Preoperational state
Operational Stage
+2s
-2s
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

FIGURE 15.6
ANNUAL LIQUID RELEASES HISTORICAL DATA
(LVNPS UNITS 1 & 2)

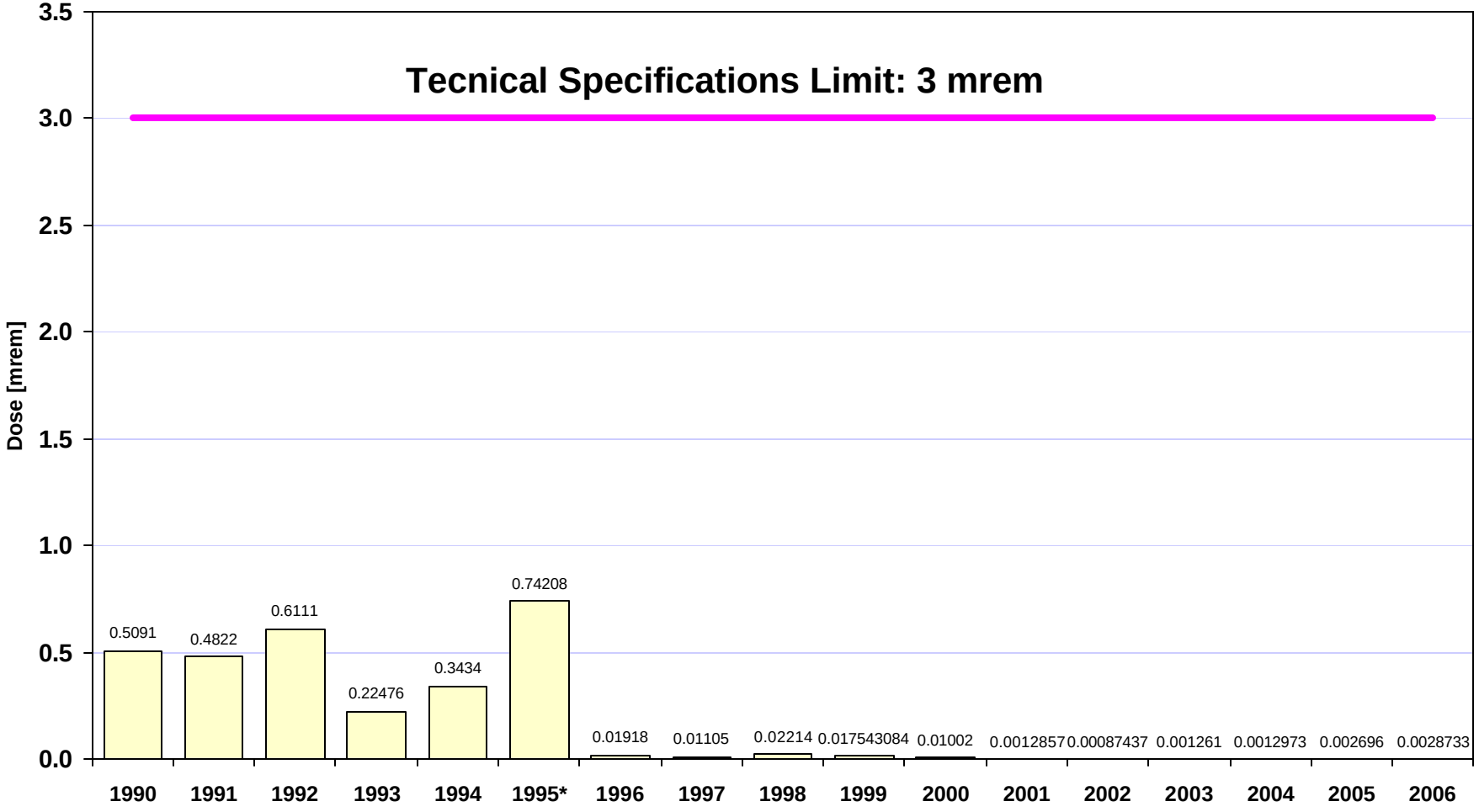


FIGURE 15.7
ANNUAL GASEOUS RELEASES HISTORICAL DATA (LVNPS UNIT 1)
NOBLE GASES

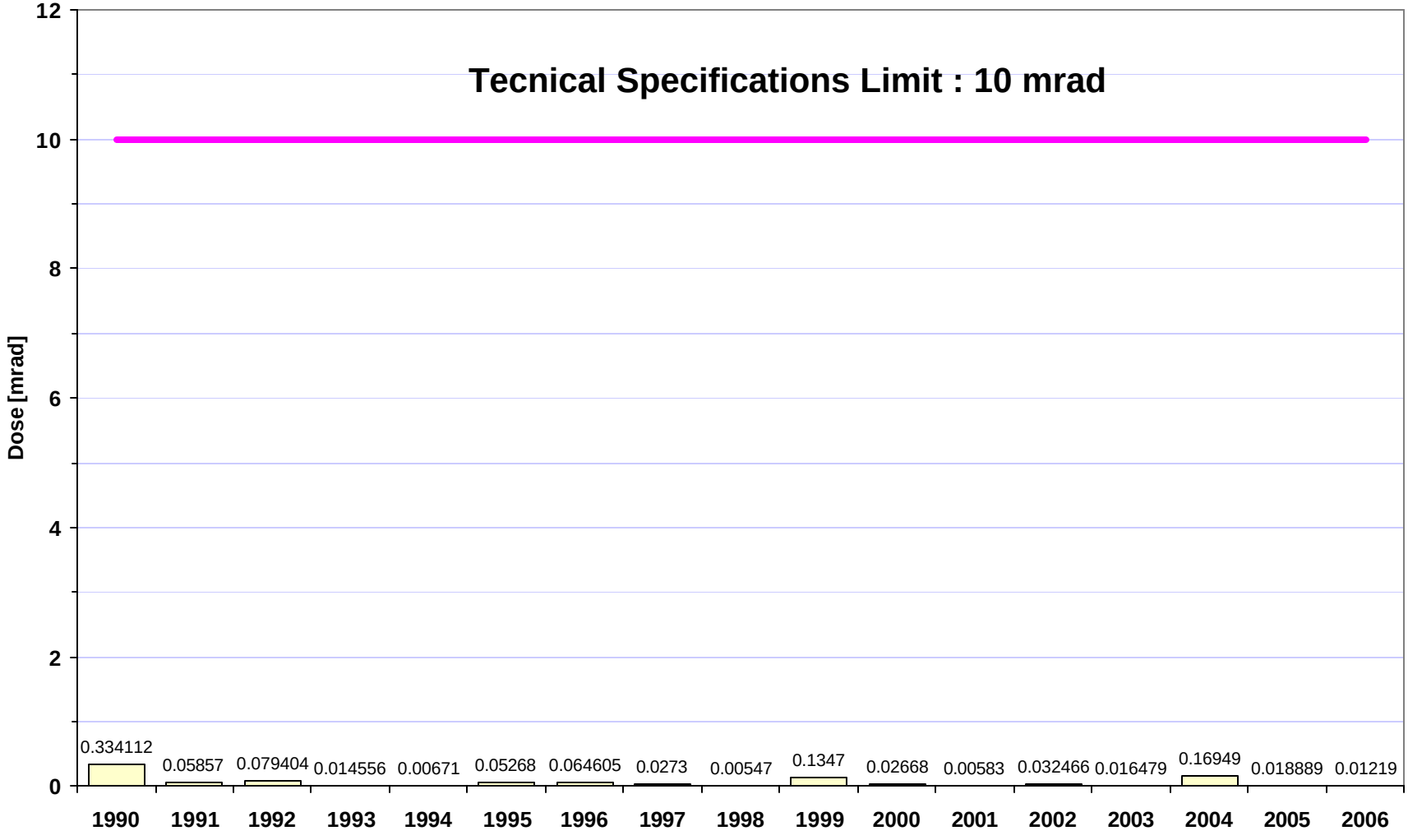


FIGURE 15.8
ANNUAL GASEOUS RELEASES HISTORICAL DATA (LVNPS UNIT 2)
NOBLE GASES

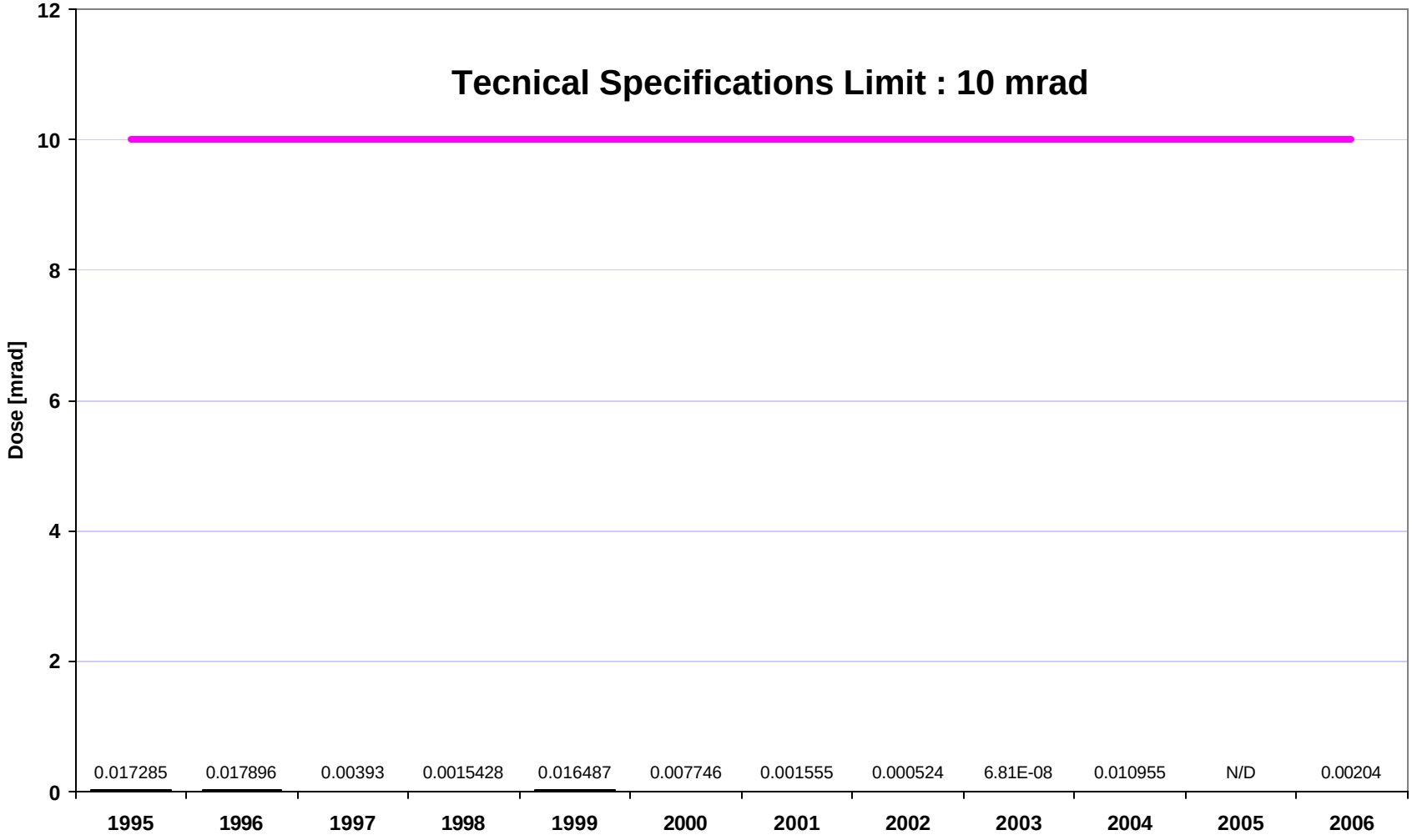


FIGURE 15.9
ANNUAL GASEOUS RELEASES HISTORICAL DATA (LVNPS UNIT 1)
IODINE, PARTICLES AND TRITIUM

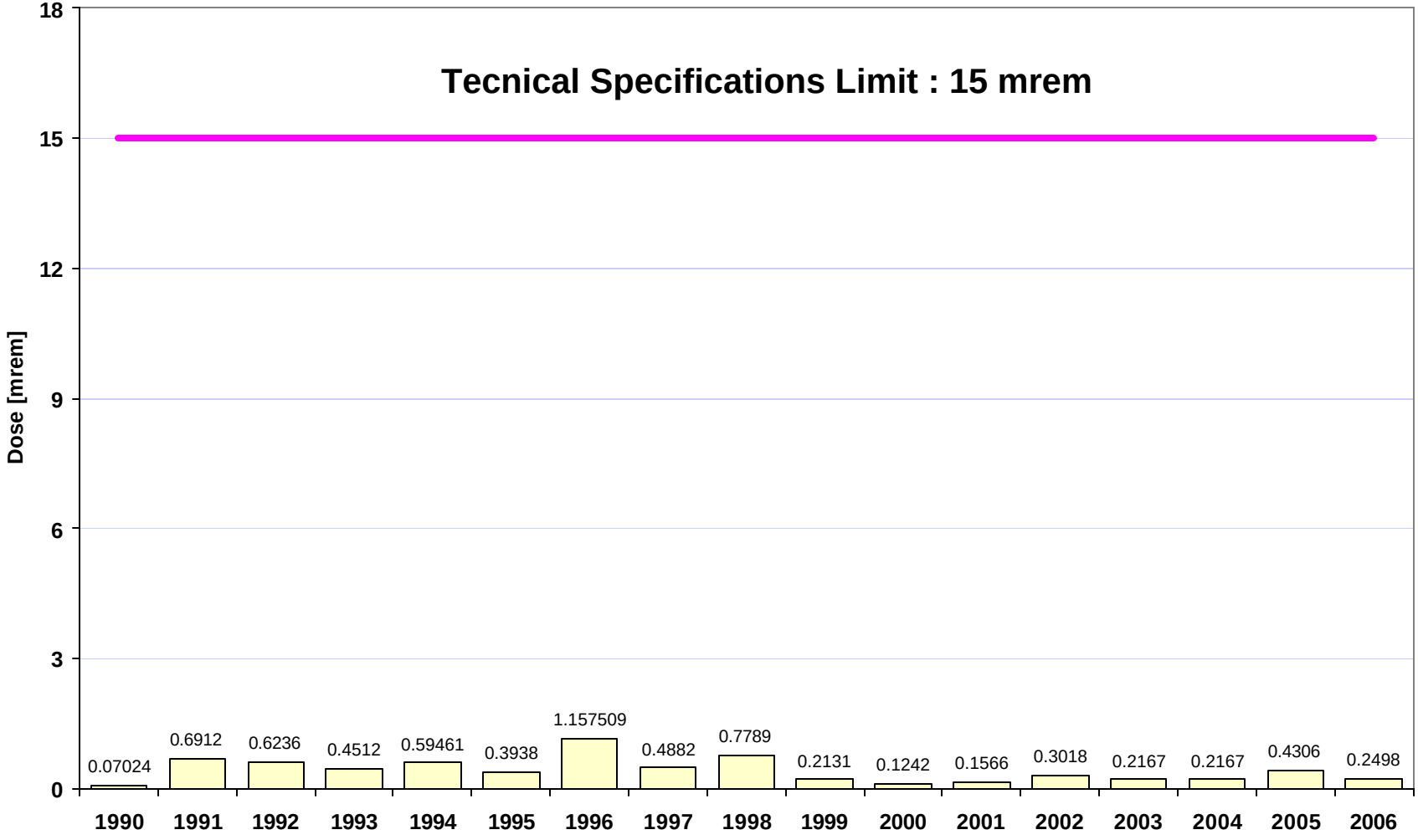
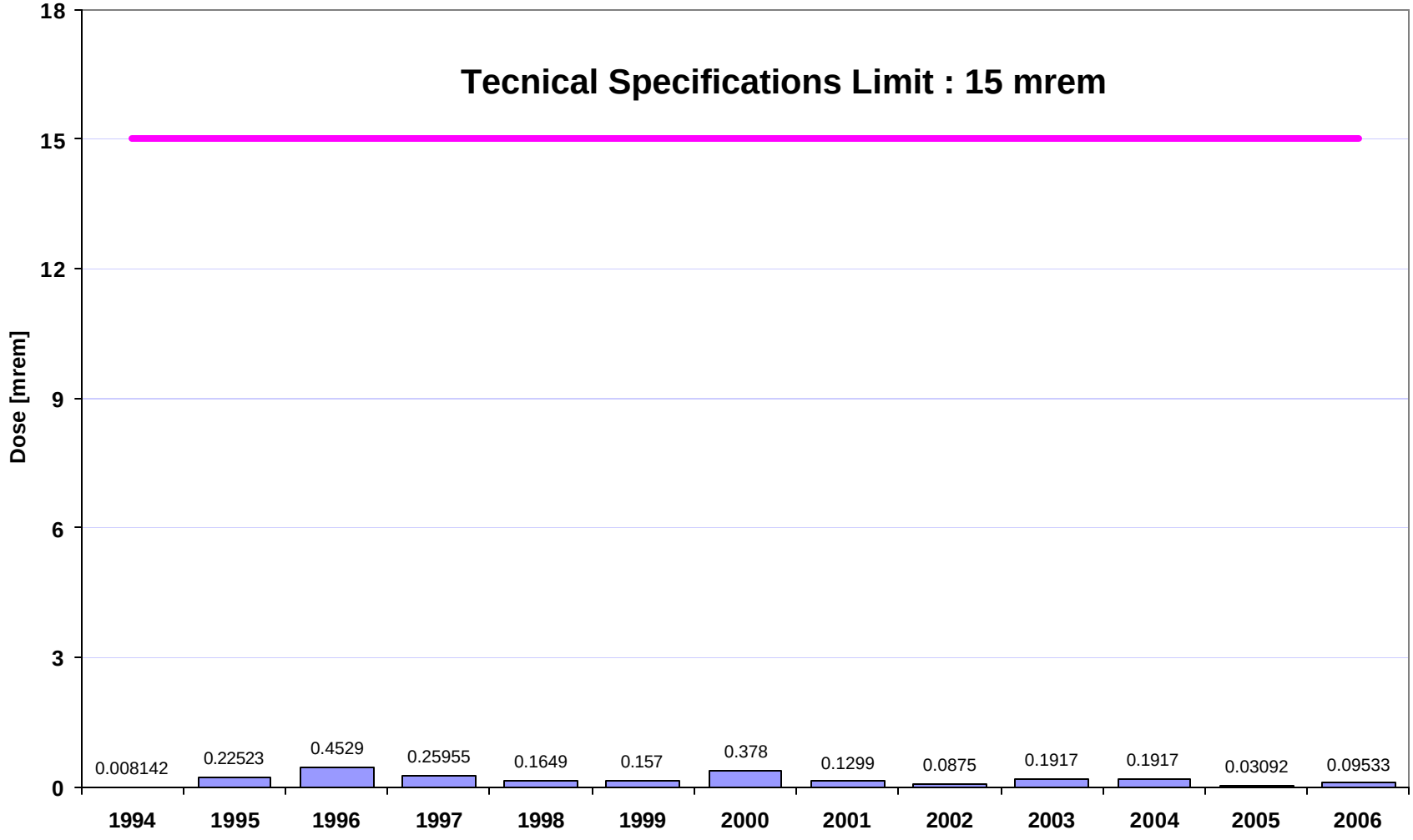


FIGURE 15.10
ANNUAL GASEOUS RELEASES HISTORICAL DATA (LVNPS UNIT 2)
IODINE, PARTICLES AND TRITIUM



ARTICLE 16. EMERGENCY PREPAREDNESS

16.1 OBLIGATIONS

1. *Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.*

   For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2. *Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.*

3. *Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.*

16.2 LVNPS EMERGENCY PLANS

16.2.1 Emergency Response Organization

Internal Emergency Plan (PEI)

The facilities that compose the Internal Emergency Plan are the following:

- Technical Support Center,
- Main Control Room,
- Operational Support Center,
- Dose Projection Center,
- Accident Evaluation Center,
- Damage Control Center,
- Radiation Control Center,
- Medical Assistance Center,
- Environmental Monitoring Center,

- Central Alarm Station,
- Decontamination and First Aid Station, and
- Post-accident Sampling Station

The Plan contemplates the existence of the following materials and equipment:

- Clothing for personal protection,
- Equipment for respiratory protection,
- Radiation monitors,
- Contamination monitors,
- High volume air monitors,
- Dosimetry Digital/Sounder,
- Primary and alternate communications systems,
- Plant alarm systems (Fire, Emergency and Evacuation),
- Intensive Care Medical Unit,
- Fire truck,
- Environmental Monitoring Unit,
- Bus for personnel transportation and
- Potassium iodine for Radiation Prophylaxis

External Radiation Emergency Plan (PERE)

The responsibility matrix of the External Radiation Emergency Plan (PERE), Table 16.1, is updated for the period 2004-2006.

16.2.2 Emergency Plan Activation Exercises/Drills

To verify the suitability and validity of the preparation for a radiation emergency in LVNPS, during the period 2004-2006 several Emergency Plan drills, either internal or external have been carried out. These are described in the next sections.

16.2.2.1 Internal Emergency Plan Exercises and Drills

The following table shows the exercises and drills that have been carried out from the year 2004 to 2006.

CONCEPT	YEAR		
	2004	2005	2006
Emergency notification	3	4	4
Fire protection	44	32	40
First aid	1	1	2
Monitoring and decontamination	3	3	4
Environmental monitoring	1	2	2
Dose projection	2	4	2
Post-Accident Sampling	3	3	4
Accident evaluation (Plant status and conditions)	2	4	2
PEI-FT-82	1	1	1
Damage control	1	2	2
Accounting and evacuation	1	2	2
Severe Storm	1	-	-

16.2.2.2 External Emergency Plan Exercises and Drills

The following table shows the exercises and drills that have been carried out from 2004 to 2006:

CONCEPT	YEAR		
	2004	2005	2006
Notification to Control Division	3	2	1
Monitoring, classification and decontamination of evacuees	4	4	2
Monitoring and decontamination of equipment and vehicles	4	4	2
Shelter activation	1	4	2
Off-site environmental monitoring	1	2	1
Exposure Control and Laboratory	1	2	1
Dose calculation	1	1	1
Accident assessment, technical analysis and protection actions	2	0	1
Technical	-	-	-
Communications	1	1	1
Logistic Support	1	1	1
Cabinet Exercise PEI/PERE	1	1	1

CONCEPT	YEAR		
	2004	2005	2006
On site counting, transport and evacuation of CR´s	1	1	1
Total	21	23	15

In 2006 an integrated exercise was performed and evaluated by CNSNS

16.3 MEASURES FOR INFORMING THE PUBLIC ABOUT EMERGENCY PREPAREDNESS

- The fundamental objective of community workshops now called “PERE fair” was to assure that information for application of protective actions was clear and understandable for Plume Zone inhabitants.

  Statistics of the community workshops imparted during 2004-2006.

	2004	2005	2006
Workshops	62	69	112
Communities	114	112	108
Participants	3355	3353	5200

16.4 REGULATORY BODY ACTIVITIES

Internal Emergency Plan

As result of the Commendable Practices for the Working Group in OECD Inspection Practices during the inspections to LVNPS Internal Emergency Plan, it was decided to carry out a series of drills to certain technical areas and to the organization in general, to verify the viability of the programs, equipment readiness and communications. As a result of these inspections the following has been found:

- After working hours, personnel of the Emergency Response Organization did not comply with the response time required in the applicable regulation.
- The emergency response personnel were not skilled enough to use respiratory protection equipment.
- Some procedures were not validated.
- Poor communication between the areas made it difficult to fulfill exercise objectives.

This caused a closer follow up from Regulatory Body through increasing inspection frequency to the responsible area until the resolution of the detected deficiencies. Three inspections were made during 2004, 2005 and 2006, in which it was ensured that previous deficiencies had been solved; nevertheless, there is still an unresolved issue from the UIIS independent auditor to the corresponding PEI from 1997. This is because two modification packages from the Standby Gas Treatment System (SGTS) are about to be implemented.

In the CNSNS "LVNPS Internal Emergency Plan Inspection" carried out by CNSNS in February 2005, improvement was observed in aspects related to the Internal Emergency Plan, as well as its implementation in LVNPS. None finding was found in that inspection.

In the "LVNPS Internal Emergency Plan Inspection" carried out in March 2006, two findings corresponding to deficiencies detected in previous inspections were registered; also, the inspection group made a finding that was not handled at the time. For this reason, it was concluded that corrective actions proposed by CFE in order to solve PEI deficiencies were not fully effective. Regardless of the impact of the deficiencies, CNSNS considered that it was not necessary to increase the frequency of inspections. As a result of this, a PEI inspection is programmed for 2007, in which deficiencies related to the Internal Emergency Plan registered in the integrated exercise PERE-2006, will be verified.

External Emergency Plan

In October 2006, the Regulatory Body carried out an integrated exercise in the Plant to prove the response capacity in an emergency situation that could bring possible risks to the population. The areas tested were:

- Capacity of PERE personnel to notify and activate its members.
- Capacity of PERE personnel to notify and activate emergency installations.
- Capacity of PERE personnel to make the right decisions regarding population protection.
- Efficient application of PERE and PEI procedures
- Capacity to decide the convenience of activating the Alternate Emergency Control Station
- Capacity to transmit information properly and timely to the media.
- Adequate capacity of organization and decision in the Control Head.
- Capacity to carry out procedures used by the Task Forces.

During the exercise, 11 people participated in the scenario development, 22 evaluators and 9 evaluators/controllers.

The exercise lasted for 10 hours, 8 national institutions as well as local organizations were activated, and 11 installations dedicated to emergency attention were verified.

As a result of the assessment, the Regulatory Body identified deficiencies in the following areas:

- Emergency handling and coordination
- Decision making process
- Radio communication
- Training

The different Task Forces are responding to deficiencies detected by the Regulatory Body.

16.5 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

16.5.1 Achievements and Changes in Safety Related Activities

In the period covered by this National Report, the following achievements and changes are reported in Emergency Plans.

External Radiation Emergency Plan

a) Acquisition of a Mobile Unit for people, equipment and vehicle decontamination.

b) Purchase of a lot in the southern part of LVNPS outside the 16 km limit to relocate southern emergency installations.

c) Acquisition of a radiological monitoring portable equipment (scintillator kind) to monitor people, vehicles and equipment.

d) Purchase of a mobile cabin for the South Exposition Control Stand.

e) Redesign the Primary Emergency Control Center

f) 8 km asphalted junction to evacuation routes N1 and S1.

g) The different task forces are responding to deficiencies detected by the Regulatory Body.

Internal Emergency Plan

a) Guide NEI-99-01 Rev.4 has been adopted and implemented, concerning to the methodology for the development of emergency action levels.

b) Compliance with regulating requirement NUREG-0654 Section B.7 related to having in 30 and 60 minutes the minimum personnel required attending an emergency and supporting personnel in turn.

c) Analysis and implementation of EPA-400 regarding Equivalent Dose Limits during emergencies for emergency response personnel.

d) CFE has taken action to solve deficiencies found by the Regulatory Body in the Internal Emergency Plan.

16.5.2 Future safety related activities and foreseen or proposed programs

In the period covered by this National Report and that corresponding to the next report, future activities for emergency plans are described.

External Radiological Emergency Plan

a) Design and acquisition of the first stage of the Speaker System to notify an emergency condition to the workers and population in a radius of 5 Km around LVNPS. This activity was postponed for 2007 and 2008.

b) By agreement with the International Atomic Energy Agency (IAEA), Mexico shall host an international exercise on a large scale in matters of nuclear emergencies, ConVex. In this exercise, an emergency with consequences to the civil population will be simulated, being LVNPS the simulator of the nuclear emergency. This will be carried out in 2008 and its purpose is to test the international response regarding nuclear emergencies and according to the Prompt Notification and Assistance Agreements in case of Nuclear or Radiological Emergencies that IAEA holds with its member countries.

Internal Emergency Plan

a) Implementation and use of RASCAL code version 3.05 for dose forecast and calculation.

b) Analysis for the implementation of a telemetry analysis for environmental monitoring in emergency situations at any Plant site.

c) Implementation of actions and programs to fulfill the regulatory requirement of NUREG-0654, Section N.1.b is in process, which requires that all personnel belonging to the Emergency Response Organization must participate in a drill at least once in a 5 year period.

As a result of the regulatory inspections of PERE and PEI, the Regulatory Body will verify that CFE provides effective solution to deficiencies detected.

16.5.3 Safety Concerns and Foreseen Actions

As result of the first stage of enlargement and construction of the Federal Highway No. 180 and changes in its route, CFE made the necessary modifications to keep the Southern installations of LVNPS current and in operation. To this date there has been no decision regarding North Installations by the Department of Communications and Transportation (SCT) on the new route of this highway, nor a date to begin its construction. Therefore, the Northern installations are still effective.

16.6 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

Based on the information presented in this article it can be shown that

- Inter-institutional structures with an appropriate infrastructure to minimize the consequences to population in case of a radiological emergency in LVNPS, are maintained
- Integral and activity-specific periodic exercises for all and each response activities to a radiological emergency are carried out.
- The CNSNS carries out the necessary assessment and surveillance activities on this issue.

Based on the information presented in this National Report, it can be concluded that obligations of the Article 16 of the CSN are satisfied.

TABLE 16.1 RESPONSIBILITY MATRIX OF THE EXTERNAL RADIATION EMERGENCY PLAN

	ACTIVITIES	RESPONSE											
		F.T.-81 SEGOB	F.T.-82 CFE	F.T.-83 SCT	F.T.-84 SEDENA	F.T.-85 SM-AM	F.T.-86 SS	F.T.-87 GEV	F.T.-88 PFP	ININ	CNA	PROFEPA	DICONSA
1	Command and Control	X	X	X	X	X	X	X	X	O			
2	Notification to the Head of Control		X										
3	Accident Assessment		X										
4	Dose Calculation		X										
5	Environmental Monitoring		X									O	
6	Protection Action Assessment		X										
7	Notification to population		O			X							
8	Information to the public	X	O					X					
9	Communications		X	O					O				
10	Network Operation	X	X	X	X	X	X	X	X	X	X	X	X
11	Control of Road Traffic				O	X			X				
12	Control of Air Traffic			X									
13	Control of Maritime Traffic					X							
14	Transportation		X		O	O		X					
15	Evacuation		O		X	X		O	O				
16	Radiation Prophylaxis		O		O	O	X	O	O				
17	Rescue				X	X							
18	Monitoring, Classification and Decontamination of People Evacuated		X		O		X			O			
19	General Medical Attention				X		X						
20	Specialized Medical Attention					X	X			O			
21	Transportation of Injured People				X	X	X						
22	Control of Exposure	X	X	X	X	X	X	X	X	X	X	X	O
23	Shelter Activation		X					X					
24	Equipment and Vehicle Decontamination		X			X		X				O	

ACTIVITIES		RESPONSE											
		F.T.-81 SEGOB	F.T.-82 CFE	F.T.-83 SCT	F.T.-84 SEDENA	F.T.-85 SM-AM	F.T.-86 SS	F.T.-87 GEV	F.T.-88 PFP	ININ	CNA	PROFEPA	DICONSA
25	Safety and Surveillance				X	X		O					
26	Attention to Victims				O		O	X					O
27	Control of Food and Water		O				X			O	O	O	

X - RESPONSIBLE O - CO-RESPONSIBLE

ARTICLE 17. SITING

17.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

i) For evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

17.2 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

The regulatory aspects, design basis and the consequences to the surroundings of the Laguna Verde Nuclear Power Station (LVNPS) due to operation, have not changed. In compliance with the General Law of Ecological Equilibrium and Environmental Protection, as well as the requirements to grant the LVNPS License for Operating, CFE presented an Environmental Report to CNSNS following the guidelines of the USNRC Regulatory Guide 4.2. The main purpose of this report is to show that the impact of the LVNPS operation will not cause important atmospheric disturbances in the site surroundings.

The effect of LVNPS operation on the environment was assessed both under normal conditions, in function of radioactive, chemical, biocide and sanitary liquid and gaseous effluents, as well as under abnormal or accident conditions, resulting from the postulation of low probability occurrences in order to verify the installation's capacity to control and mitigate them.

An environmental monitoring program has been installed for the station's normal operation, enforced by Section 12 of Technical Specifications of LVNPS 1 and 2; this program began in the preoperational stage to determine the comparison base line in

order to have an immediate and early detection of any environmental deterioration effect.

Before granting the Licenses for Operation of LVNPS Units 1 and 2, CNSNS assessed the environmental report concluding that the real impact of LVNPS operation will only affect the environment in ways that fully satisfy the objectives of the installation design. Regarding the monitoring program, besides the adequacy and reliability of the program developed and implemented by CFE and of the international comparison analysis that its results are subject to, in 1979 CNSNS began a program of environmental sample measuring to determine the base line and monitoring during the operation independent from that of CFE. To date, results obtained by CFE are coherent with those obtained by CNSNS with no significant statistic variations identified with respect to the pre-operational values of background radiation.

Based on the information presented in this National Report, it can be concluded that obligations of the Article 17 of the CSN are satisfied.

ARTICLE 18. DESIGN AND CONSTRUCTION

18.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that:

i) The design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

ii) The technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

iii) The design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

18.2 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

The regulatory and design aspects, the implementation of defense in depth philosophy, the design criteria and structure, system and component classification, the proven validity of Laguna Verde Nuclear Station (LVNPS) design and construction have not changed.

CNSNS has surveyed all LVNPS 1 and 2 design, purchase, construction and testing activities through assessments, inspections and audits, as well as through the continuous testimony by Resident Inspectors. Any change that modifies the compliance with codes (for example, ASME Code Cases) and standards has been approved by CNSNS.

During the phases of design, construction, pre-operational and start up tests, the Regulatory Body has exercised its authority to carry out inspections, declare findings, and demand corrective actions to prevent the recurrence of deviations; likewise, it has assessed the fulfillment of commitments regarding norms and standards during these phases.

In the construction and pre-operational phase, the Regulatory Body revised and approved the modifications to the original design, before granting the Initial Fuel Load Permit.

Since the LVNPS Units 1 and 2 began their commercial operation, CNSNS has assessed the main modifications presented by CFE to safety related systems,

components and procedures; CNSNS has also witnessed the execution of system performance tests after the modifications were made.

Therefore, based on the information presented in this National Report, it can be concluded that the obligations of the Article 18 of the CSN are satisfied.

ARTICLE 19. OPERATION

19.1 OBLIGATIONS

Each Contracting Party shall take the appropriate steps to ensure that:

i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

iv) procedures are established for responding to anticipated operational occurrences and to accidents;

v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

vi) incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;

vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

19.2 SAFETY ANALYSIS DURING OPERATIVE STAGE AT LVNPS

This topic from the internal (CFE) and external (CNSNS and others) point of view is addressed in detail in sections 14.2.1 and 14.2.2, respectively of this National Report.

19.3 NOTIFICATION OF INCIDENTS

As an update, Figure 19.1 shows the Notifications of Reportable Events from some years previous to the beginning of commercial operation in the LVNPS (1988 for LVNPS Unit 1 and 1994 for LVNPS Unit 2) until the closing year of this report, December 2006.

19.4 OPERATIONAL EXPERIENCE

19.4.1 Internal Operational Experience

A Corrective Action Program began in February 2004. It follows guidelines and recommendations from INPO and WANO and serves as a tool to identify undesired situations and to reinforce safety and reliability of the units. As an update, Figure 19.2 shows the Condition Reports from January 2004 to December 2006 in LVNPS.

In the period 2004-2006, the most important events that have occurred in LVNPS are the following:

- On July 11, 2004, with LVNPS Unit 1 operating at full power, after a programmed power reduction, a level transient occurred (level 8) due to a signal of loss of feedwater flow to loop “B”, due to a blown fuse, causing a Main Turbine Trip, feedwater pump trip and SCRAM due to valve closure in the Main Turbine.

- On September 22, 2004, with LVNPS Unit 1 operating at full power, in the Main Control Room, high flow and high pressure alarms in preheater “A” of the Off-Gas System were present in Panel BB-13, causing a rapid vacuum loss of the Main Condenser. A rapid power decrease began, with recirculation and with the insertion of 2 control rods, the power set at 76 and 77% of the Nominal Thermal Power (PTN). After the low vacuum alarm appeared in the Condenser, the turbine was tripped and the reactor scrammed manually. The vacuum loss was due to a break in the excess lubricating oil collector pipe from the Low Pressure Turbine, at the union with the exit steam diffusor of that turbine. This was caused by fatigue in the drain pipe welding union with the turbine diffusor, which was caused by insufficient support.

- On December 2, 2006, with Unit 2 at full power, the activation of a low pressure in the main turbine oil alarm caused a turbine trip, followed by SCRAM in the reactor. The cause was damage in the diaphragm of turbine trip device due to aging.

- On February 13, 2006, with Unit 1 operating at 98.8% power, during maneuvers to find the failure in the flow indicator controller of the condensate and feedwater system, the operators performed a manual reactor SCRAM, in anticipation of the

level decrease because of feedwater loss due to the trip of 2 condensate boosters pumps caused by failure of the check valve at the discharge of one of the condensate pumps, caused by an error in following the operational procedure, by shutting down the third condensate booster pump without lowering the power as required by procedure.

- On March 8, 2006, with Unit 2 operating at full power, an alarm indicated loss of 125 VCD division 1 due to the failure of the power distribution panel. A manual SCRAM was performed and the Reactor Core Isolation Cooling system was put in service. The transient caused the automatic start up of emergency systems. According to procedures, a state of ALERT was declared due to the unplanned loss of Div. I and a significant transient in course; this lasted for 5 minutes after which the event was recategorized as an Unusual Event due to the quick recovery of the level. The cause was a failure in the negative terminal due to a false contact in the distribution panel.

19.4.1.1 Containment Performance

As an update, Figure 19.3 shows the primary containment performance (Integrated Leakage Rate Test) for both LVNPS units from 1984 to 2006.

At request of CFE in order to reduce maintenance personnel dose, CNSNS authorized the adoption of option “B” Appendix “J” of 10 CFR 50 to carry out the Primary Containment tests.

19.4.2 Regulatory Body Activities

The CNSNS reviews that event reports submitted by LVNPS comply with established regulations. When an event important or of special interest to safety occurs, CNSNS carries out an in depth evaluation and investigation of its causes, impact on safety, the existence of recurrent events and follows up on corrective actions established to solve deficiencies detected. The CNSNS also determines the relevance of event to decide if it merits a special inspection is required to perform an in depth investigation.

19.5 RADIOACTIVE WASTE TREATMENT SYSTEMS

19.5.1 Liquid Radwaste System

The collected liquid radwaste comes from different sources. Based on this they are classified as: equipment, floor, regenerating and chemical, detergents and laundry and, miscellaneous drains.

They are treated through a batch process, maintaining surveillance and control of its chemical quality by sampling analysis and:

- For re-use purposes, the compliance with established chemical parameters is according to LVNPS procedures.
- When it will be released, its radioactive material content is analyzed to assure that any discharge is As Low As Reasonably Achievable (ALARA) fulfilling the requirements specified in 10 CFR 20 and 10 CFR 50, including the design dose objective specified in 10 CFR 50 Appendix I.

Currently and with the objective of continuous improvement, a new treatment system denominated Inverse Osmosis is being implemented for high conductivity liquids that will service both LVNPS units, and it is estimated to have the new system in operation by the end of the third quarter of 2007. With this CFE seeks for the following results:

- Increasing the re-use rate to values higher than 98%
- Reducing dose to critical organs (gastrointestinal tract) from effluents release to less than 0.001 mR/year. This is to 10,000 times less than the Technical Specification limits
- Reducing solid waste generation to less than 80 cubic meter/year per LVNPS unit
- Reducing treatment costs

19.5.2 Gaseous Waste Treatment

The information related to the Gaseous Waste Treatment at LVNPS has not changed so information described in past National Reports is still valid (See Annex II, section 19.8.2).

19.5.3 Solid Waste Treatment

This subsystem is designed to collect and process wet and dry waste generated at LVNPS, in order to confine them in a safe and reliable way inside appropriate containers for its later isolation, to be contained in steel drums or in High Integrity Containers made of high density polyethylene.

The solid waste processing is controlled by LVNPS Process Control Program (PCP), to fulfill the requirements specified in Technical Specifications, 10 CFR 61 and in the Mexican Official Norm NOM-019-NUCL-1995 (See Table 7.1 of this National Report).

Wet waste may be treated by following processes:

a) Extrusion with asphalt, resulting in a homogeneous solid monolith inside a drum and free of water
b) Cementation resulting, in a homogeneous solid concrete monolith inside a drum and free of water

c) Cyclic drain inside a high integrity container where the water free content is reduced to less than 1% in volume

The dry waste treatment can be carried out by:

a) Hydraulic compression for those compactable with reduction factors 4:1
b) Direct pack for those non-compactable

Sources of wet solid waste are: spent ionic exchange resins, sludge from phase separators, chemical concentrates from laboratory wastes, regenerating and decontamination solutions. Sources of dry solid waste are: cartridge filters, clothes, paper, plastics, thermal insulation, sand, granulated metal and contaminated replacement components.

In LVNPS Unit 1, drums and High Integrity Containers (HIC) with processed waste are stored initially in the decay area, inside the Radwaste Building and later are transported to the Temporary Wet Waste On-Site Storage (ATS). In LVNPS Unit 2, HIC containing processed waste are transported immediately to the ATS. These containers with processed waste are handled by remote means.

The high polyethylene integrity containers and the steel drums are manufactured with radiation, structural and corrosion resistance, and in accordance with the seismic design and Quality Assurance requirements for their definitive storage.

LVNPS has three solid waste temporary storage areas:

1.- In Plant Temporal Storage (ATP) inside the Radwaste Building, with storage capacity for wet and dry waste HIC´s and steel drums of 55 gallons for two years of operation
2.- Temporary Wet Waste On-Site Storage (ATS) outside the double fence, but inside the site, to store wet waste HIC´s and drums of 55 gallons, with appropriate capacity for 15 years of LVNPS (both units) operation
3.- Dry Solid Radwaste Storage (DDRSS) outside the double fence, but inside the site, to store dry waste drums of 55 gallons, with an appropriate capacity for 15 years of operation

During the LVNPS Unit 1 startup and with the definitive storage absent, it was decided to design and build a Temporary Wet Waste On-Site Storage (ATS), for the low and medium level waste. This was licensed as storage area extension to the Radwaste Treatment Building. This installation was built in 1991, with initial storage capacity for 5 years of operation at both units for original waste production design. Based on the policy for LVNPS waste reduction, improvements were carried out in the waste production process, as well as in the storage area redistribution and adaptation that have resulted in a storage capacity increase until the year 2007. In

2006, procedures for ATS extension began, since it is reaching its maximum storage capacity. It is planned that this extension will conclude at the end of 2008, with a storage capacity for this kind of waste for 20 more years.

Also to provide enough capacity for dry waste storage, in 1993 a Dry Solid Radwaste Storage or DDRSS was habilitated and licensed, which has capacity until 2007 with the current volumes. In 2006, the corresponding studies for the application of additional volume reduction method for stored waste in DDRSS began, with the purpose to increase storage capacity since it is also about to reach capacity. A super-compacting process is planned for 2007 to reduce the volume in a 4:1 factor of approximately 6000 containers with compactable solid waste. For volume reduction in metallic wastes, a decontamination process is planned, which is expected to reduce waste volume to approximately 20% of the current volume which is around 300 cubic meters. Through the application of the described processes, the useful life of the current DDRSS is expected to increase to 10 or 15 more operation years in both LVNPS Units.

With the objective of continuous improvement, CFE is in the process of incorporating a new wet solid treatment system. This system is a dryer/granulator and will service both LVNPS units and will substitute the extruders-evaporators that have operated for 15 years. Also, their technology will increase the final waste rate from 4 to 1. With these actions CFE seeks to maintain a reliable waste solidification and reduce wet solids volume to reach goals for solids to values less than 70 m^3/year per LVNPS Unit.

Reactor tools and unusable reactor components, such as control rod spent blades, failed fuel rods, etc. are stored in the Spent Fuel Pool.

19.5.4 Spent Fuel Storage

The information related to the Spent Fuel Storage has not changed, so the information described in past National Reports is still valid (See Annex II in its section 19.8.4).

19.5.5 Radioactive Waste Production-Reduction Program

In relation to LVNPS radwaste generation minimizing processes, several strategies are being putting in place, some of them are:

- Processes for segregation of radioactive material and decontamination of tools and objects, in a more efficient, clean and easy manner with the operation of new segregation and decontamination workshops.
- Oil incineration with traces of radioactive contamination (under contract in the U.S.)
- Super-compressing solid compactable wastes and selective division and decontamination of non compactable wastes, mainly metal wastes.

- Optimization of the use materials to preserve equipment, tools and objects free of contamination (that at the same time generate radwaste).

19.6 AGING MANAGEMENT AND PLANT LIFE EXTENSION

The information on Aging Management and Plant Extension has not changed, thus the information presented in the past National Reports continues being valid (See Annex II, section 19.9)

As a preventive measure for reactor internals and to protect the reactor coolant pressure boundary, the following actions were implemented to improve the water chemistry.

- Unit 1: In the 11th Refueling Outage (September 2005) Noble Metals were added and two months later, Hydrogen Injection began.

- Unit 2: In the 8th Refueling Outage (April 2006) Noble Metals were added and one month later, Hydrogen Injection began.

Additionally, in 2005 the CFE began a Technical Cooperation Project with IAEA to establish a Life Cycle Administration Plan for LVNPS, which includes the revision of Aging Programs for structures, systems and components. One of the products of the project will be the future emission of License Renewal Request for the Regulatory Body as per 10 CFR 54 of USNRC. The Life Cycle Administration Program has been integrated into the LVNPS reliability process.

19.7 LVNPS-1 & 2 PERFORMANCE INDICATORS (PI´s)

Among these indicators those related to safety and reliability are considered, which are used by the World Association of Nuclear Operators (WANO) as a way to collect and interchange operational experience. LVNPS Units 1 & 2 apply them as a means for performance comparison with other similar power stations and to emulate the best international practices.

PERFORMANCE INDICATORS FOR LVNPS-1 & 2 (2003)

INDICATOR (PI)	UNITS	LVNPS-1	LVNPS-2	WANO GOAL FOR 2006(*)
NUCLEAR SAFETY				
RHR SystemUnavailability	%	0.0008	0.0009	0.020
Diesel Generator Unavailability	%	0.0001	0.0007	0.025
High-pressure Injection System Unavailability	%	0.0016	0.0042	0.020
Automatic SCRAM's X 7000 Critical Hours	Number	0.42	0.42	0.50
Chemistry Index	Number	1.03	1.00	1.01
Collective Exposure to Radiation	Man-Rem	65.405	230.862	120
RELIABILITY				
Unplanned Capacity Loss	%	0.80	0.96	1

* less than or equal to

19.8 ACTIVITIES, ACHIEVEMENTS AND CONCERNS ON SAFETY ENHANCEMENT

19.8.1 Achievements and changes in Safety Related Activities

Within the period of this National Report, the following achievements in LVNPS can be mentioned:

- As a preventive measure for reactor internals and to protect the reactor coolant pressure boundary, the following actions were implemented to improve the water chemistry in LVNPS Units 1 and 2: Addition of Noble Metals and Hydrogen Injection.
- Also, CNSNS authorized the adoption of option "B" Appendix "J" of 10 CFR 50 to carry out Primary Containment tests, which will contribute to dose reduction in maintenance personnel.

19.8.2 Future safety related activities and foreseen or proposed programs

In the period covered by this National Report and the corresponding to the next report, LVNPS will carry out the following activities concerning radwaste treatment:

- Installation of an advanced high conductivity liquids treatment system (inverse osmosis and ultra filtration) to reduce the dose for liquids release and to reach a factor of 10,000 times less then Technical Specifications limits, as well as to increase the water re-use to 98% of the total water processed. CFE estimates this system to be operating at the end of the 3rd quarter of 2007.
- Installation of a new drying system for concentrated wet solid waste to diminish the processed waste volume to values less than 70 m^3 per LVNPS Unit. With this system a final radwaste rate 1 to 1 will be reached and not the current 1 to 4. CFE began its installation and is estimated to end in the 3rd quarter of 2007.
- Reprocessing by super compressing of compacted dry waste, with a reduction factor 4 to 1, increasing storage capacity from 10 to 15 more years.

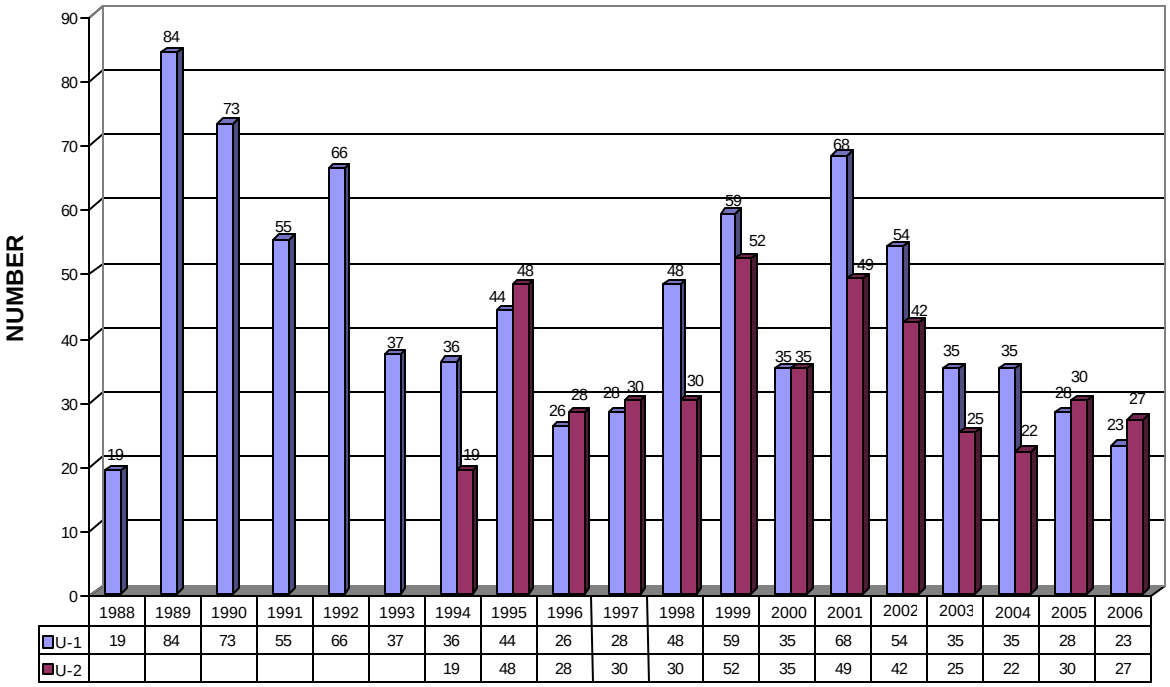
19.8.3 Safety Concerns and Foreseen Actions

Concerning LVNPS operation, the licensee as well as the Mexican Regulatory Body considers that there are no safety issues of concern, so it is not necessary to implement preventive or corrective measures.

19.9 EVALUATION OF THE LEVEL OF COMPLIANCE WITH CONVENTION OBLIGATIONS

Based on the information presented in this National Report, it can be concluded that the obligations of Article 19 of the CSN are satisfied.

NOTIFICATION OF REPORTABLE EVENTS / YEAR
LVNPS UNITS 1 AND 2



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
U-1	19	84	73	55	66	37	36	44	26	28	48	59	35	68	54	35	35	28	23
U-2							19	48	28	30	30	52	35	49	42	25	22	30	27

FIGURE 19.1

INTERNAL EVENTS / YEAR
LVNPS UNITS 1 AND 2

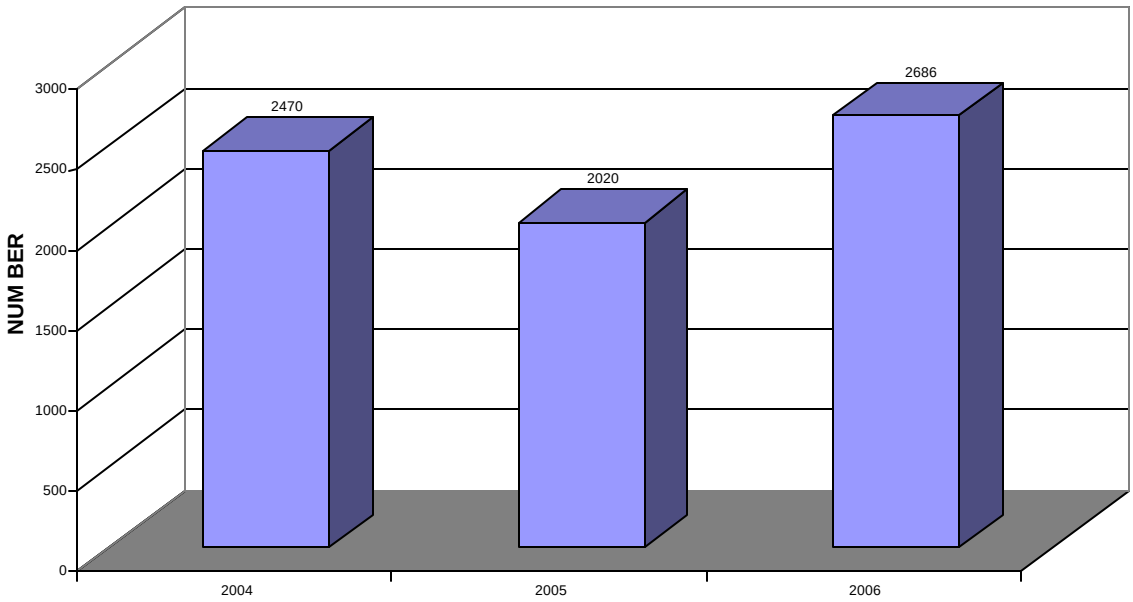


FIGURE 19.2

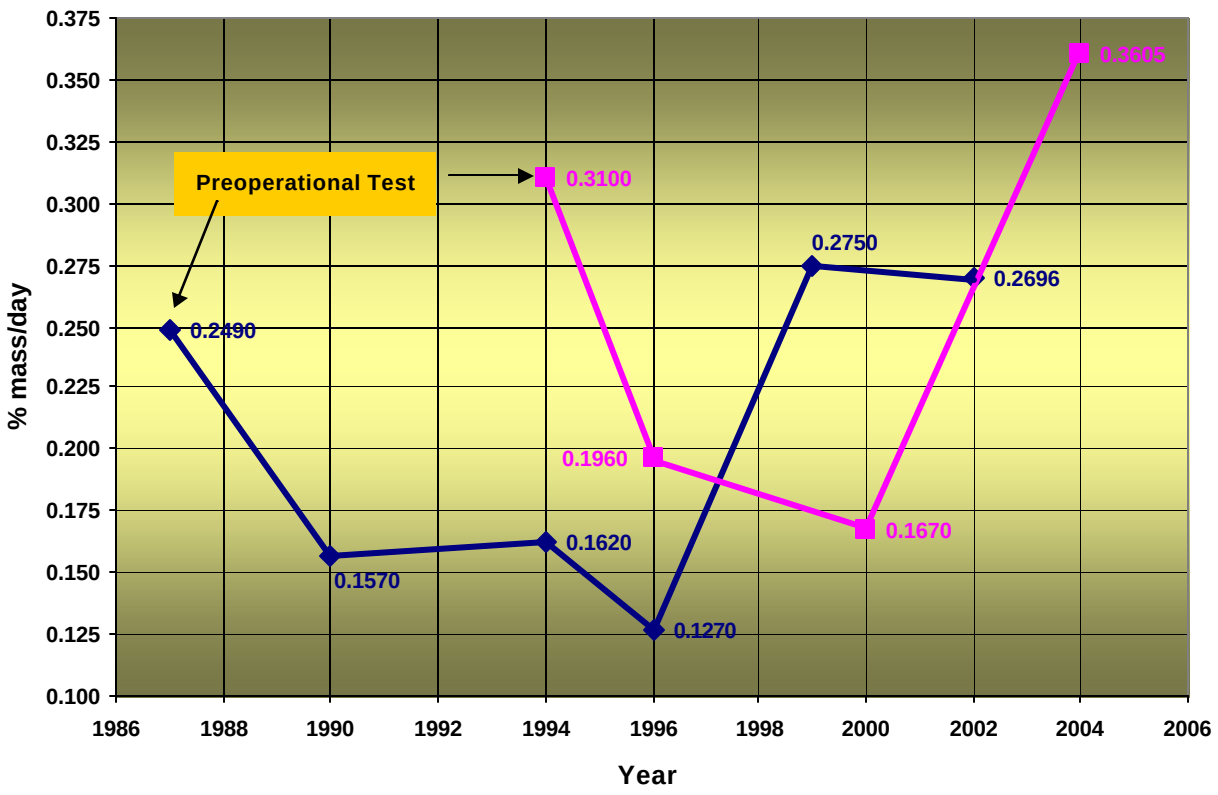

INTEGRATED LEAKAGE RATE TEST OF LVNPS PRIMARY CONTAINMENT
% mass/day
Year
Preoperational Test
0.2490
0.1570
0.1620
0.1270
0.2750
0.2696
0.3100
0.1960
0.1670
0.3605
Unit 1
Unit 2
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006

FIGURE 19.3

ANNEX I

LIST OF EXISTING NUCLEAR INSTALLATIONS

Name	Laguna Verde Unit 1	Laguna Verde Unit 2
License No.	CNLV-1/1	CNLV-2/1
PRIS Code	MX-1	MX-2
Type	BWR	BWR
Thermal Power MWt	2027	2027
Net Capacity MWe	682.44	682.44
Operator	CFE	CFE
NSSS Vendor	General Electric	General Electric
Cooling	Open, Gulf of Mexico	Open, Gulf of Mexico
Construction Date	1-October-1976	1-June-1977
First criticality	8-November-1988	6-September-1994
Grid Connection	13-April-1989	11-November-1994
Commercial Operation	24-July-1990	10-April-1995
License Expiration Date	24-July-2020	10-April-2025

ANNEX II

National Report presented by the United Mexican States to fulfill the obligations under the Convention on Nuclear Safety

Parts without change

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK

7.1 INTRODUCTION

This article presents a summary of the Laws, Standards and Regulations that support the Mexican institutions related to nuclear and radiation safety and the licensing process for nuclear power plants by the Regulatory Body. It must be understood that it is not the intention of this article to reproduce in full the Laws and Rules cited within; whatsoever additional information is presented at the end of this Article, to provide a wider vision of the national regulatory framework.

7.2 NATIONAL REQUIREMENTS AND PROVISIONS

The legislative and regulatory framework under which the principles and obligations deriving from the Convention on Nuclear Safety are supported, is based on the Political Constitution of the United Mexican States (hereinafter denominated “the Constitution”) from which a series of laws, regulations and standards are derived.

The Constitution, in its Article 27, establishes that nuclear energy must be only used for pacific applications and that the exploitation of nuclear fuels for the generation of nuclear energy as well as the regulation of its application to all areas corresponds to the Nation.

In accordance with the Constitution, the generation of electric power by nuclear means is considered a strategic area and the public sector is exclusively responsible for such activity. Consequently, the Mexican State has created the organisms and companies necessaries for the efficient handling of such strategic areas under its responsibility.

Likewise, the Constitution in its Article 89, Fraction I empowers the President of the Republic to *“promulgate and execute the laws issued by the Congress of the Union, providing the administrative support for allowing its exact observance”.* It is in this sense that the Federal Executive Branch, through the Department of Energy, regulates and supervises compliance with the provisions on nuclear safety and radiation protection matters, attribution based on Article 33, Fraction X of the Organic Law of Federal Public Administration.

Moreover, this Law grants to the Department of Energy, the warrant to exert the rights of the Nation on nuclear energy matters as well as regarding the utilization of products and natural resources required to generate, transmit, transform, distribute and supply electricity having the objective to render public services and *“to direct the activity of the state entities whose objective is related to the generation of electric and nuclear energy in attachment to the law on ecological matters”* (Article 33, Fractions II and III, respectively).

By virtue of Article 17 of the Organic Law on Federal Public Administration, Mexican State Secretaries are authorized to count on semi-autonomous administrative organisms under them to offer more effective attention as well as to settle affairs of competence efficiently. These organisms shall have specific responsibilities to resolve matters within national territory, which is determined in each case in accordance with legal provisions.

This Article supports from an administrative point of view, the creation of the *Comisión Nacional de Seguridad Nuclear y Salvaguardias "CNSNS"* (hereinafter denominated "the Commission"). Being a semi-autonomous organism dependent of the Department of Energy, it operates as the Regulatory Body responsible for overlooking nuclear safety, radiological safety and security as well as safeguards within the national territory.

The Regulatory Law of the Constitutional Article 27 on Nuclear Matters (hereinafter denominated "the Nuclear Law") entered into effect on February 5, 1985, and awards the Federal Electricity Commission (*Comisión Federal de Electricidad: CFE)* exclusively, the responsibility for generating electricity from the use of nuclear fuels. It also corresponds to this institution, the design and construction of nuclear power plants taking into account the opinion of the *Instituto Nacional de Investigaciones Nucleares*: ININ (National Institute for Nuclear Research). The Nuclear Law also establishes that the utilization of nuclear reactors for non-energetic purposes shall only be taken up by the public sector and by universities, institutes and research centers authorized according to the Law.

CFE, upon being a paraestatal decentralized organization of the Public Administration, has legal and patrimonial faculties of its own according to provisions foreseen in Article 45 of the Organic Law of Federal Public Administration.

As established in Article 17 of the Nuclear Law, being that the nuclear fuel is property of the Nation, the Federal Executive branch may only authorize its use under the terms settled by this Law and continuously under surveillance of CNSNS.

The Nuclear Law establishes in its Article 19 that *"safety is the prime importance for all activities involving nuclear energy and it should be considered during planning, design, construction and operation up to the definite shutdown and decommissioning of nuclear and radioactive installations as well as in the disposition and final destination of all the waste".*

The Nuclear Law defines nuclear safety as the series of actions and measures lead to avoid nuclear equipment, material and installations as well as their operation from producing undue risk to the health of the population and their property or damage to the quality of the environment (Article 20). It also defines as an objective of radiation safety *"to protect workers, the population and their property, and the environment in general,*

through the prevention and containment of the effects that could result from exposure to ionizing radiation" (Article 21).

The Nuclear Law establishes the difference between a nuclear and a radioactive installation. A nuclear installation is defined as *"the installation in which nuclear fuel or material is manufactured, processed, used, reprocessed or stored".* A radioactive installation is an "*installation in which radioactive material or equipment containing it is produced, manufactured, stored or use; or in which radioactive wastes are treated, conditioned or stored"* (Article 3, Fraction II and III, respectively).

In addition, the Nuclear Law establishes that nuclear and radioactive installations must have nuclear safety systems to satisfy the requirements established to this respect in other ordinances and regulatory provisions of the Law (Article 22 Paragraph Two). In the same way, it anticipates in its Article 27, Paragraph Three that *"nuclear installations shall have the required nuclear and radiation safety personnel, and that the head of the corresponding public agency shall be responsible for the strict compliance with the applicable regulations".*

Article 23 of the Nuclear Law contemplates that when somebody is aware of an incident involving nuclear materials or fuels, radioactive materials or equipment containing them or of conditions that could give rise to such an incident, the Commission shall be notified immediately. In such cases, the Commission may order or carry out the removal of equipment, tools or materials that imply some kind of risk, so that they may be deposited in places with the proper safety conditions.

The Nuclear Law establishes bases for implementing a system for awarding licenses both for nuclear and radioactive installations as well as for the suspension of such licenses in the event of non-compliance with some of the established conditions.

It is an indispensable requirement for nuclear and radioactive installations to satisfy the requirements established within the regulatory provisions of the Nuclear Law for siting (selection, survey and evaluation of location), design, construction, operation, modification, suspension of operations, definitive shutdown and decommissioning. These requirements shall be determined attending the risk related to operations in which radioactive material is involved and as a function of the isotope activity and radiotoxicity present (Article 25).

According to provisions established in Article 26 of the cited Law, the actual Department of Energy (former Department of Energy, Mines and Parastatal Industry) is empowered to award authorizations for siting, design, construction, operation, modification, suspension of operations, definitive shutdown and decommissioning of nuclear and radioactive installations. Similarly, it is established in this Article that authorizations for the construction and operation of such installations shall have a fixed validity and their renovation, modification, suspension or cancellation shall be ruled by the respective regulations.

Authorizations for the construction and operation of nuclear installations shall be awarded only when accredited by presenting pertinent information on how the safety objectives are going to be reached and what procedures and methods shall be used during the siting, design, construction, operation, modification, definitive shutdown and decommissioning phases including the corresponding Radiological Emergency Plan. Also, information must be provided on the installation's environmental impact (Article 28 of the Nuclear Law). Additionally, authorization is required for handling, transportation, storage and custody of nuclear materials and fuel, radioactive material and equipment containing them and shall be ruled by regulatory provisions in the Nuclear Law (Article 30).

For the license awarding process, the Nuclear Law anticipates that the Commission must forward an opinion on siting, design, construction, operation, modification, suspension of operations, definitive shutdown and decommissioning of nuclear installations, prior to authorization by the Department of Energy, (Article 50 Fraction IV).

7.3 REGULATORY AUTHORITY

The Nuclear Law empowers the CNSNS as the organism responsible for the revision, evaluation and authorization of the bases for siting, design, construction, operation, modification, suspension of operation, definitive shutdown and decommissioning of nuclear and radioactive installations as well as all related to the fabrication, use, handling, storage, reprocessing and transportation of nuclear materials and fuels, radioactive materials and equipment containing them; and for the processing, conditioning, release and storage of radioactive wastes and any disposal of them (Article 50 Fraction III).

7.4 LICENSING PROCESS

The National Commission of Nuclear Safety and Safeguards is, as mentioned in earlier sections, a semi-autonomous unit of the Department of Energy. It has the responsibility to verify the compliance with the national and international regulations that apply to the design, construction, start up and operation of nuclear installations.

The Commission has established the so-called "Licensing Process" adopted from 10 CFR of the USA for the awarding of construction permits and operation licenses. It consists of two stages and initiates with the formal submittal of the construction permit application accompanied by a description of the features and safety systems the installation will have to assure it will not represent an undue risk. Among the documents of support for the CFE request are the following:

- Preliminary Safety Analysis Report (PSAR)

- Preliminary Environmental Impact Report (PEIR)

During this stage, the Regulatory Body reviewed the design criteria (characteristics of the structures, systems and components, nuclear analysis, etc.) and in particular all the issues related to the impact of the site characteristics on the design of the structures, systems and components of the installation and the impact of the installation on the environment. Once the reports are reviewed, a technical evaluation is emitted to the Department of Energy so to have the basis to award the Construction Permit.

During the construction of the LVNPS, the Regulatory Body conducted audits and inspections in order to verify that it was built in accordance with that established in the safety report and in the conditions established in the Construction Permit.

Once finalized the detailed design of the installation, as the 2ª stage in the licensing process, the proprietor requested the Operating License, for which the following information was submitted:

- Safety Analysis Report, Second Stage (ISSE),
- Final Environmental Impact Report (IFIA).

The Regulatory Body evaluated these documents, including the sections relative to the criteria applied to the development of the preoperational and startup tests, as well as the Technical Specifications. This in addition to the results of the audits and inspections by CNSNS made it possible to issue the report for the LVNPS to obtain its Operating License.

7.5 ASSESSMENT SYSTEM AND REGULATORY INSPECTIONS

In a nuclear installation, the role of the Commission consists in reviewing that the design, construction and operation criteria are in accordance with its own codes and regulations and those adopted from the nuclear industry.

An example of the most important aspects revised during this phase are those in relation to the site where the installation is to be constructed. That includes parameters that may affect the design, such as the site seismology, severe meteorology (probable maximum hurricane) as well as other aspects of interest. Information related to the distribution of the population, current and future, is reviewed.

Review of reports by the Regulatory Body includes the formulation of questions in order to eliminate concerns existing within the documents, specify modifications to the design and impose additional requirements in the event that the existing ones are considered to not guarantee safety. After the assessment of these reports, a technical statement is

forwarded to the Department of Energy for issuance of the Construction Permit. This statement includes recommendations and conclusions on the installation's safety.

During construction, the Commission overlooks, by performing inspections and audits, that the plant is constructed in accordance with the provisions established in the safety report and in the construction permit as well as with specific conditions.

Inspections and audits performed by the Regulatory Body are aimed to verify the efficiency of the plant's internal control systems and organizations, including the Quality Assurance organization as well as the direct verification of the correct performance of activities.

Irregularities detected are analyzed in order to define their importance and according to formal procedures, these are followed-up until proven and documented corrective measures are implemented to ensure their non-recurrence.

Once the detailed design of the installation is finalized, the operation license can be requested. For this, another detailed report is to be sent to CNSNS on the plant's safety. The report is known as the Final Safety Analysis Report (FSAR) and it contains the same information as the preliminary report (PSAR), only that the information doesn't have a generic character but specific to the installation. Likewise, a Final Environmental Impact Report is prepared in which the environmental surveillance program is included. It is to be maintained during the useful lifetime of the plant, to monitor the effect it has on the environment, having as a basis all measures performed during, at least, five years prior to the plant's operation.

The CNSNS review of the FSAR includes the evaluation of real operating conditions. Acceptance criteria applied to pre-operational tests, start-up tests (as well as how these impact on the analysis of accidents) and during commercial operation (in the first report these were generic) and proposed technical specifications are also evaluated. Once the Commission approves these operational technical specifications, they become part of the Operating License that rules over the installation's operation. Also, one assessment is made of the scope of the proposed activities to be developed in connection with the inspections to components important to safety during the installation's lifetime (in-service inspection) and it is verified that operation personnel is well trained.

When construction progress is such that safety-related equipment and component tests may be initiated, the Commission witnesses the execution of the tests and analyses the results in order to verify that the equipment satisfies design criteria.

The original version of the FSAR shows the recently completed detailed design of the plant. The FSAR is continuously updated until the plant is put into service, and thenceforth, in a periodic way, to reflect always the detailed "as built" description of the plant.

To provide a foundation for the awarding of the operating license, the Commission prepares a technical statement that includes recommendations and conclusions. This statement is submitted to the Department of Energy, and based on the recommendations, proceeds to award or not the license.

Furthermore, the Commission continues its independent supervision during the whole operational life of the plant to verify compliance with the approved safety procedures and practices.

Specifically for LVNPS the Regulatory Body Assessment System has not changed, nevertheless, it can be pointed out that the annual assessment program is designed considering the commitments and regulatory requirements, the anticipated design modifications, programmed refuel outages, and licensee projects as well.

With respect to the regulatory inspection process in the operational stage of LVNPS, during 1998-2000 the definition of the objective of risk informed inspection was incorporated into the process. As a result of the recommendations and suggestions made by IAEA-IRRT Mission on January, 2001 (see Article 8 of this National Report), the inspection process has had the following modifications:

- A coordinator for inspection activities for LVNPS was designated. This coordinator is in charge of supervising the inspection planning and verifies its performance, every six months, to provide feedback to the inspection program.

- The inspection program is developed according to the IAEA Safety Guide 50-SG-G4, on biennial basis, considering the impact that inspected areas have on safety. The main areas inspected during LVNPS operational stage are: Operation, Radiation Protection, Maintenance, Engineering, Emergency Preparedness, Quality Assurance, Performance of Supervisors and the Organization.

- CNSNS inspections were reclassified in: planned (announced and un-announced), unplanned, reactive and augmented.

7.6 ASSURANCE OF COMPLIANCE WITH SUSPENSION, MODIFICATION AND REVOCATION MEASURES

Based on the Article 32 of the Nuclear Law, nuclear and radioactive installations must be subject to inspections, audits, verifications and recognitions by the Commission, to corroborate the conditions of nuclear and radiological safety and the compliance and observance of the legal dispositions in this matter.

In accordance with the result of these inspections and audits, the Commission emits a report in which the deficiencies and anomalies found and the terms allotted for their correction are indicated. After this, the adopted measures to correct the anomalies or

deficiencies will be monitored to ensure that they comply with the established law (Article 33, Nuclear Law).

In the event of an imminent risk or danger for personnel at a nuclear or radiation installation or for the general public, the Commission, by orders of the Department of Energy, may provisionally occupy a nuclear installation (Article 34 of the Nuclear Law). Similarly, the Commission may order and execute as a preventive measure, the provisional, partial or total shutdown of radioactive or nuclear installations as well as contaminated effects, setting the periods to correct deficiencies and anomalies. In the case that those deficiencies or anomalies are not corrected within the period granted, the Commission with the help of the corresponding technical resolution shall proceed to its definitive closure.

The safety measures above mentioned may apply to those cases in which construction, adaptation or preparation authorizations for an installation are cancelled or suspended, therefore, such actions shall not be continued. Likewise, these measures shall be carried out in those cases where activities involving nuclear materials and fuels, radioactive materials and equipment containing them are performed, without the required authorization, permit or license (Article 35 of the Nuclear Law).

Suspension and cancellation of authorizations granted as well as fines and safety measures shall be imposed by the Department of Energy, through the National Commission on Nuclear Safety and Safeguards on the basis of the results of the checks, audits, verifications and inspections effected and bearing in mind the evidence and pleadings of the interested parties. In every case the decision handed down in this regard shall be motivated by and grounded on the provision of this law and its regulations, and other applicable ordinances (Article 36 of the Nuclear Law).

Articles 37, 38 and 39 of the Nuclear Law establish a penalty system to be applied in the event of violation to the precepts arising from the same and from regulatory provisions, regardless of whether such infraction is a cause for suspension, cancellation or revocation of the license awarded.

7.7 LAWS, REGULATIONS AND REQUIREMENTS RELATED TO NUCLEAR SAFETY

Mexico has committed itself to apply safety and health protection measures observed in Informative Circular No. 18/Rev.1, upon signing an Agreement with the International Atomic Energy Agency (hereinafter denominated “the Organism”) whereby, the Organism would render support for the execution of a project related to a nuclear power plant (INFCIRC/203). Hence, Mexico applies and is committed to comply with the Basic Safety Standards of the Organism and with the safety conditions recommended in parts corresponding to the Organism’s practical guides. Guides related to the “exploitation of nuclear plants without risk” and to the “design and construction of reactors without risk”,

including the Organism guides related to the “organization of regulatory activities for power reactors” and the “siting of reactors from a seismic land characteristic point of view”.

Furthermore, it is important to point out that from the beginning of the Laguna Verde project, governmental authorities decided that in addition to applying the Organism’s recommendations, the regulatory standards of the country of origin for the steam supply system would apply. This requirement appears in Condition No. 3 of the Operating License for both Laguna Verde Units. For this reason, Title 10 “Energy” of the Code of Federal Regulations of the United States of America was established as a regulatory requirement as well as all industrial standards and guides derived from it. In a similar manner, US Regulatory Guides issued by the Nuclear Regulatory Commission have been adopted.

Radiation Safety related aspects are regulated based upon the General Regulation for Radiological Safety in force since November 23, 1988. This regulation establishes requirements on the Dose Limit System (Title Three), on the Licensee, Head of Radiation Safety and Personnel Occupationally Exposed (Title Seven), on Radiation Accidents and Preventive or Safety Measures (Title Nine), on Authorizations, Permits, Licenses (Title Ten) and Administrative Procedures (Title Eleven), including inspections, audits, verifications and examinations as well as penalties and recourse of reconsideration.

There is also the Regulation for Ground Transportation of Hazardous Materials and Residues, in force since April 8, 1993. Provisions of this Regulation apply to the transportation of Class No. 7 Materials “Radioactive Materials” in which the *Department of Communications and Transports* is the competent authority. However, this does not exclude the faculty of the *Department of Energy*, through the Commission, to authorize transportation of nuclear and radioactive materials.

The Law on Civil Liability for Nuclear Damages is also part of the Mexican legislation. It has been in force since January 1, 1975. This Law establishes an indemnity financial system for people affected by a nuclear accident. As indicated in this Law, the operator is responsible for the damage occasioned by all nuclear accident that may occur within an installation under his/her responsibility. To this effect, the Nuclear Law establishes that the Federal Electricity Commission is the only organization authorized to generate electricity, making use of nuclear fuels (Article 15).

International Treaties are included in the Mexican Legislative Framework. Once approved by the Senate of the Republic, these Treaties acquire the character of a Mexican Law. To this effect, it is important to mention that Mexico forms part of the following Conventions:

- Convention on the Prevention of Sea Contamination from Dumping Waste and Other Materials. It came into effect for Mexico on May 27, 1974.

- Convention on Physical Security for Nuclear Materials. It became effective in Mexico as of June 4, 1988.

- Convention on Assistance in the Event of a Nuclear Accident or Radiation Emergency. It became effective in Mexico as of June 10, 1988.

- Convention on Prompt Notification of Nuclear Accidents. It became effective in Mexico as of June 10, 1988.

- Convention on Civil Liability for Nuclear Damages. It became effective in Mexico as of July 25, 1989.

- Convention on Nuclear Safety. It became effective in Mexico on March 24, 1997.

In addition to the Nuclear Law, there is the General Law of Ecological Equilibrium and Environmental Protection, which became effective January 29, 1988 and the was reformed and entered into effect December 14, 1996. This Law in Chapter VII of the Nuclear Law (Article 154) establishes that *"The Department of Energy and CNSNS, including the participation of the Department of Health, shall assure that the exploration, exploitation and benefit of radioactive minerals, the development of nuclear fuels, the utilization of nuclear energy in general, activities related to the same, are carried out in adherence to official Mexican standards on nuclear, radiation safety and physical security for nuclear or radioactive installations and, in such a manner that human health risks are avoided and the preservation of the ecological equilibrium and environmental protection are ensured. It corresponds to the Department to perform the environmental impact assessment."*

The Department of Environment and Natural Resources is responsible for performing the environmental impact assessment. However, it is important to state that the evaluation of the effect on the surrounding of the nuclear installations, from the point of view of radiological safety, corresponds to the Commission.

LEGISLATIVE AND REGULATORY FRAMEWORK WHICH PREVAILS IN THE SAFETY OF NUCLEAR INSTALLATIONS IN THE UNITED MEXICAN STATES

I. POLITICAL CONSTITUTION OF THE UNITED MEXICAN STATES

Article 25, Paragraph four

In an exclusive manner, the public sector shall be in charge of strategic areas given in Article 28, paragraph four of the Constitution, maintaining the Federal Government ownership and control over organisms which in may be established.

Article 27, Paragraph seven

It also corresponds to the nation to exploit nuclear fuels for the generation of nuclear energy as well as to regulate its application for other purposes. Nuclear energy may only be used for pacific purposes.

Article 28, Paragraph four

Functions executed by the State in an exclusive manner and within the following strategic areas shall not constitute monopolies: post office, telegraph and radiotelegraphy; petrol and other hydrocarbons; basic petrochemistry; radioactive minerals and the generation of nuclear energy; electricity and activities expressly determined by the laws issued by the Congress of the Union.

II. INTERNATIONAL TREATIES

1. Treaty for the Proscription of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty), taking effect on September 19, 1967.

2. Treaty on the Non-Proliferation of Nuclear Weapons (TNP), taking effect on December 7, 1968.

3. Agreement between the United Mexican States and the International Atomic Energy Agency for the application of safeguards related to the Treaty for the Proscription of Nuclear Weapons in Latin America and the Treaty for the Non-Proliferation of Nuclear Weapons in the Caribbean, taking effect on March 29, 1973.

4. Agreement between the International Atomic Energy Agency and government of the Mexican United States (INFCIRC/203), for which the organism shall provide support in the execution of a project related to a nuclear plant. This agreement took effect on February 12, 1974.

5. Convention on the Prevention of Sea Contamination from the Dumping of Waste and Other Matter, taking effect on July 17, 1975.

6. Convention on Physical Protection of Nuclear Materials, put into force on June 4, 1988.

7. Convention on Assistance in the Event of Nuclear Accident or Radiation Emergency, put into force on June 10, 1988.

8. Convention on Prompt Notification of Nuclear Accidents, put into force on June 10, 1988.

9. Convention on Civil Liability for Nuclear Damages, put into force on July 25, 1989.

10. Convention on Nuclear Safety, put into force on October 24, 1996.

III. NATIONAL LAWS AND REGULATIONS

1. The Regulatory Law of the Constitutional Article 27 on Nuclear Matters. This Law entered into effect on February 6, 1985.

2. Law on Civil Liability for Nuclear Damages. This Law entered into effect on January 1, 1975.

3. General Law of Ecological Equilibrium and Environmental Protection. This Law entered into effect on January 29 1988. It was reformed and entered into effect December 14, 1996.

   Chapter VII, Article 154. *The Department of Energy and CNSNS, including the participation of the Department of Health, shall assure that the exploration, exploitation and benefit of radioactive minerals, the development of nuclear fuels, the utilization of nuclear energy in general, activities related to the same, are carried out in adherence to official Mexican standards on nuclear, radiation safety and physical security for nuclear or radioactive installations and, in such a manner that human health risks are avoided and the preservation of the ecological equilibrium and environmental protection are ensured. It corresponds to the Department to perform the environmental impact assessment.*

4. General Regulations for Radiological Safety. These regulations entered into effect on November 23, 1988.

5. Regulations for Road Transportation of Hazardous Materials and Wastes. These regulations entered into effect on April 8, 1993.

6. CNSNS has generated a series of technical standards on diverse topics of nuclear and radiological safety.

IV. TECHNICAL SPECIFICATIONS

The Licensee's Technical Specifications are a requirement that must be attached to the application for license. The technical specifications come from analyses and evaluations presented in the safety analysis report. This document establishes the surveillance requirements to ensure the operability of equipment systems important to safety within terms of the Operation License.

V. IAEA SAFETY STANDARDS

CNSNS carried out a comparative analysis of the scope of the IAEA´s NUSS standards as regards to the scope of the norms and guides generated by the USNRC; it was found that the latest standards and guides cover that described in those of the IAEA, therefore, it is a common practice to apply the USNRC standards and guides.

VI. SAFETY STANDARDS OF THE COUNTRY OF ORIGIN OF THE NUCLEAR STEAM SUPPLY SYSTEM (NSSS)

From the beginning of the Laguna Verde Nuclear Power Station project, in 1972, following the example of countries like Japan and Spain, the governmental instances involved in the project made the decision to apply, in addition to the regulations of the International Atomic Energy Agency, the regulations of the country of origin of the nuclear steam supply system; that is, the regulations of the United States of America. This is contained in Condition No. 3 of the operation license for both LVNPS units.

In the above context, Title 10 "Energy" of the Code of Federal Regulations of the United States of America was adopted as a primary requirement.

In particular, the regulatory framework for licensing LVNPS-1 & 2 was agreed upon between the Regulatory Body and CFE, in which is specified the compliance with the 10 CFR Parts:

Part 20 "Standard for Protection Against Radiation"

Part 21 “Reporting of Defects and Noncompliance”

Part 50 “Domestic licensing of production and utilization facilities”

- A “General Design Criteria”
- B “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants”.
- E “Production and Utilization Installation Emergency Preparedness and Plans”
- G “Fracture Toughness Requirements”
- H “Vessel Material Surveillance Program Requirements”
- I “Numerical Guide for Design Objectives and Operation Limit Conditions to Satisfy the “As Low As Reasonably Achievable” Criteria for Radioactive Materials in Nuclear Power Plant Effluents”.
- J “Light-Water-Cooled Reactor Primary Containment Leak Tests”
- K “Emergency Cooling System Assessment Models”

Part 55 “Operator’s Licenses”

Part 73 “Physical Protection of Plants and Materials”

Part 100 “Reactor Site Criteria”

USNRC regulatory guides provide acceptable methods to meet the regulatory requirements for nuclear power plants in the U.S.A. To this respect, CNSNS in agreement with CFE decided upon the specific adoption of the regulatory guides and compliance methods previously shown, adapting them according to the circumstances and time of application.

The series of Regulatory Guides applied to LVNPS are as follows:

- Series 1, Power Reactors and Nuclear Installations
- Series 4, Environmental Radiological Surveillance
- Series 7, Radiation Protection
- Series 8, Physical Protection
- Series 9, Radioactive Waste Management

ARTICLE 8. REGULATORY BODY

8.1 INTRODUCTION

The Mexican Regulatory Body in matters of nuclear safety, radiological safety and safeguards is the *Comisión Nacional de Seguridad Nuclear y Salvaguardias* (National Commission of Nuclear Safety and Safeguards). CNSNS was established by The Regulatory Law of the Constitutional Article 27, on January 26, 1979. According to provisions in section 7 of this National Report, Articles 13, 17, 18, 19, 23, 28, 29, 32, 33, 34, 35, 36, 37 and 50 of the Nuclear Law, amended in 1985, provided full support to its functions.

According to results of a strategic planning carried out by the Regulatory Body and initiated in 1993, the mission of CNSNS was defined as follows: ***To ensure that activities involving nuclear materials, radioactive materials and ionizing radiation sources be carried out exclusively for pacific uses and with maximum safety for the public and environment, considering the current technological development.***

8.1.1 Historical Evolution of the Regulatory Body

So far the most important events in the history of the Mexican Regulatory Body (*Comisión Nacional de Seguridad Nuclear y Salvaguardias*) are as follows:

1955.- On December 19, the National Commission for Nuclear Energy (*Comisión Nacional de Energía Nuclear)* was created as an organism responsible for managing all affairs related to nuclear resources, including the control and surveillance function for the nuclear energy generation.

1979.- The Regulatory Law of the Constitutional Article 27 on Nuclear Matters was published on the 26th of January in the Official Gazette (*Diario Oficial de la Federación),* giving rise to, among other organisms, the CNSNS as a semi-autonomous organism reporting to the Secretary of Patrimony and Industrial Development *(Secretaria de Patrimonio y Fomento Industrial).* Its primary objective is to impose the standards that apply to nuclear safety, security, radiological safety and safeguards for the operation of nuclear and radioactive installations to be performed with maximum safety for the country's inhabitants.

1982.- Based on the Decree of reforms and additions to the Organic Law of the Public Federal Administration, published in the Federal Official Gazette on December 29, the Department of Patrimony and Industrial Development changes its name to Department of Energy, Mines and State-owned Industry, conferring new attributions to the Commission and ratifying previous activities.

1983.- On May 9, the Interior Regulation is published by the new Department of Energy, through which the Commission adopts an organization and coordination scheme that allows improvement of the use of resources and efficiently comply with the assigned programs.

1985.- The issue of the new Regulatory Law of the Constitutional Article 27 on Nuclear Matters dated February 4, that abrogates the one published on January 26 of 1979, assigns new attributions to the CNSNS which leads to the reorganization of internal areas, with the following results:

The Division of Nuclear Safety is made up of three Departments, in order to coordinate the tasks necessary for verifying that the operation of the nuclear installations does not produce undue risk to the environment, health and property of the population.

The Radiological Safety Division with three departments as well, has the responsibility of resolving license applications and authorizing possession, use, transfer, distribution, storage, transportation and disposition of radioactive material.

The Technology, Regulation and Services Division is formed by two departments, in order to plan and coordinate research in nuclear and radiation matters, providing technical support (Regulations, Safety Guides, etc.), necessary for the assessment of the nuclear installations.

1988.- On January 4th, the Planning and Budgetary Department issues provisions of public expense rationing, which influence the Federal Executive entities. Nevertheless, the Commission does not undergo any modification since its organic structure is composed of essential areas to its good performance.

1989.- With the Agreement by which administrative units of the Department of Energy, Mines and State-Owned Industry, area organically assigned, published in the Federal Official Gazette on March 24th, 1989, the Commission no longer pertains to the Undersecretary of Energy and now depends on the Secretary of the Branch; this change does not modify the internal structure of the Commission, by virtue of having responded in a satisfactory way to the achievement of its objectives.

1993.- Economic changes that occur in the national and international environment, cause the Federal Executive directs its policies towards economic reorganization and stabilization, foreign trade opening and public finance restitution.

In this way, government and state-owned entities are considered for national modernization and productivity, enforcing them to adopt rationality schemes in the use of available resources.

In this framework, on July 1st and November 25th, the new Interior Regulation for the Department of Energy, Mines and State-owned Industry and a decree by which the

Federal Executive amends, adds and derogates several provisions thereof are published. Both documents reflect a restructure of the Entity, which among other modifications, creates two new decentralized organisms. Nevertheless, this does not affect the existence of the Commission which is functionally reorganized and adapts the denomination of some of its areas.

1994.- On November 11th, the Federal Official Gazette publishes the agreement in which the power relative to the elaboration and observation of the Mexican Official Standards, jurisdiction of the Department of Energy, Mines and State-owned Industry are delegated to the heads of the administrative units. This is why powers are granted to the Commission's General Director to write and publish the Mexican Official Standards regarding nuclear matters.

With the purpose of updating the coherence of operations by Federal Government Institutions with the reality of our country, as well as the intention to reduce public expenditure exercised by them, the Organic Law of Federal Public Administration is amended, published in the Federal Official Gazette in December 28th. The Department of Energy, Mines and State-owned Industry changes to the Department of Energy, and modifies its authority and competence. The Commission does not present modifications due to this amendment.

1995.- As a result of the change of denomination to Department of Energy, and with the purpose to make known its new attributions and competence, on June 1st the Interior Regulation of the Department of Energy is published in the Federal Official Gazette, which presents some non substantial changes as to the authority of this Commission.

1997.- On July 30th 1997, the Federal Official Gazette publishes the Decree that amends the Interior Regulation of the Department of Energy in its article 48, paragraph VI, which indicates that the General Direction of Environmental Safety and Protection will support the National Commission of Nuclear Safety and Safeguards and the General Direction of Energetic and Radioactive Resources, in the compliance of its attributions, as to ensure that the exploration, exploitation and benefits of radioactive minerals, the use of nuclear fuel and nuclear energy, and in general, activities related to it, are carried out in compliance with the Mexican Official Standards on nuclear, radiation and physical safety of nuclear or radiation facilities, so as to avoid human health risks and ensure the preservation of ecological equilibrium and environmental protection, according to the applicable laws.

2001.- On June 4th 2001 the Federal Official Gazette publishes the current Interior Regulation of the Department of Energy, in which no changes are perceived as to the specific authority established by the Regulatory Law, Article 27 of the Constitution in Nuclear Matters, and further applicable legal provisions, for the Commission; nevertheless in the amendments to this article, published in the Federal Official Gazette on January 26th, 2004, with its amendment of Article 33, in the expressed absence of it,

the assignment of all those decentralized from the Energy sector to the Secretary of the Branch was established, to agree on the matters of its competence.

8.2 ATTRIBUTIONS AND RESPONSIBILITIES

According to provisions stipulated in The Regulatory Law of the Constitutional Article 27 on Nuclear Matters, specifically Article 50, the primary attributions of CNSNS are to establish and verify that the application of nuclear safety, radiological safety, security and safeguards standards and regulations for the operation of nuclear and radioactive installations as well as usage, handling, transportation and possession of nuclear and radioactive materials are carried out with a maximum of safety by direct users and for the public in general.

In view of such attributions, CNSNS performs several activities that include:

- Licensing of nuclear and radioactive installations
- Audits, supervisions, technical visits, inspections and verifications to nuclear and radioactive installations.
- Inspections and audits related to physical security and safeguards.
- Examination and licensing of nuclear installations operators.
- Assessment of Environmental Radiological Surveillance Programs.
- Assessment of Quality Assurance Programs.
- Elaboration of standards and regulations
- Issue of licenses and permits for the importation, use, transportation and storage of radioactive material.
- Assessment and licensing of permanent radioactive waste repositories.
- Take part in agreements for technical assistance and international co-operation.
- Execution of research and development projects independently or in association with other regulatory bodies or research centers.

8.2.1 Interrelation of the Regulatory Body with other Entities of the Nuclear Sector

CNSNS establishes and maintains a close relationship with organizations that perform similar functions or whose co-operation and support is useful in the performance of its functions. Referring to the national scenario, the following organizations can be mentioned:

- **ININ National Nuclear Research Institute (Instituto Nacional de Investigaciones Nucleares).** Contractor of CNSNS to perform research on

topics related to Probabilistic Safety Analysis within specific areas of External Events and the development of Improved Technical Specifications.

- **IIE Electric Research Institute (Instituto de Investigaciones Eléctricas).** This institute has provided technical and scientific support, including training on matters such as power systems, quality of the power supplied on safety systems, etc.

The relationship of the CNSNS with these organizations has not caused any conflict of interest, since they have developed their activities with a high level of responsibility and ethics, respecting the confidentiality of information and the work contracts include clauses to ensure this.

As part of the tasks for the assessment and verification of the adequate preparation and execution of External Radiation Emergency Plan (PERE) for LVNPS, CNSNS has the authority to evaluate the behavior of the following dependencies taking part of this Plan:

- Secretaria de Gobernación - SEGOB (Department of the Interior)
- Comisión Federal de Electricidad - CFE (Federal Electricity Commission)
- Secretaria de Comunicaciones y Transportes -SCT (Department of Communications and Transportation)
- Secretaria de la Defensa Nacional -SEDENA (Department of Defence)
- Secretaria de Marina y Armada de Mexico, SM-AM (Department of Navy)
- Secretaria de Salud -SS (Department of Health)
- Gobierno del Estado de Veracruz - GEV (State Government of Veracruz)
- Preventive Federal Police (PFP)
- Instituto Nacional de Investigaciones Nucleares - ININ (National Nuclear Research Institute)
- Comisión Nacional del Agua - CNA (National Commission of Water)
- Procuraduría Federal de Protección al Ambiente (Environmental Protection Agency, PROFEPA)
- Governmental agency for nutrition of inhabitants in marginal conditions, DICONSA

In the International Context, agreements are maintained with the following organizations:

- IAEA (International Atomic Energy Agency). CNSNS maintains agreements, treaties and projects, primarily on technical and scientific co-operation.

- OECD/NEA (Organization for Economic Co-operation and Development/Nuclear Energy Agency). CNSNS participates in the following committees: Steering Committee of the NEA, Nuclear Regulatory Activities Committee, Radiation

Protection and Public Health Committee, Nuclear Science Committee and Safety of Nuclear Installations Committee (Group 2 – Cooling Systems Behavior and Group 5 –Risk Assessment).

- US NRC (US Nuclear Regulatory Commission). CNSNS has signed agreements to exchange information on nuclear and radiological safety and for technical personnel training.

- Nuclear Safety Council of Spain. CNSNS holds a technical co-operation and operational experience information exchange agreement.

- Executive Secretary of Nuclear Matters of Cuba. CNSNS has a technical co-operation and operational experience information exchange agreement.

- Nuclear Safety Centre of Cuba. CNSNS has a bilateral covenant to exchange information on nuclear safety and training of personnel.

- Iberoamerican Nuclear Regulatory Forum. This Forum discusses the progress and improvements of national regulatory systems in Ibero American countries that have nuclear power plants in operation and under construction, propitiating technical co-operation and exchange of information on nuclear and radiation subjects.

8.3 RESULTS FROM THE IRRT MISSION TO THE REGULATORY BODY

From January 15-26, 2001 the IAEA International Regulatory Review Team (IRRT) mission was carried out to inspect the Regulatory Body.

The mission covered the following areas: A “Legislative and Governmental Responsibilities”, B “Authority, Responsibilities and Functions of the Regulatory Body”, C” Organization of the Regulatory Body”, D ”Authorization Process”, E “Review and Assessment”, F “Inspection and Enforcement for Nuclear Facilities”, G “Development of Regulations and Guides”, H ”Emergency Preparedness”, I “Radioactive Waste Management and Decommissioning” and J “Radiation Protection”.

ARTICLE 9. RESPONSIBILITY OF THE LICENSEE

9.1 INTRODUCTION

As required by The Regulatory Law of the Constitutional Article 27 on Nuclear Matters, the owner of nuclear installations is entirely responsible for ensuring safe operation. The CNSNS activities are devoted to demonstrate that all the organizations that work for CFE, including contractors, develop their activities under set standards and regulations.

The regulatory framework also establishes that nuclear installations must employ the required nuclear and radiation safety personnel, and the holder of any type of license or corresponding authorization shall be responsible for strict compliance with applicable laws.

From a financial backing point of view in the event of an accident, since 1989, Mexico deposited the document of assent to the Convention on Public Liability for Nuclear Damages (referred to as the Vienna Convention); therefore, the Mexican State becomes the guarantor of the minimum amount established by such Convention in the event of an accident at any nuclear facility. To this respect, it is important to mention that the CFE, a Federal Organism and proprietor of Laguna Verde's Nuclear Power Plant, maintains an insurance to comply with this requirement.

It is important to reference that Article 4 of the Law of Public Liability for Nuclear Damages dated December 29, 1974, points out in Article 4: *"The operator's public liability for nuclear damages is objective";* that is, the operator of LVNPS is responsible for potential damages originated by the installation.

9.2 RESPONSIBILITY OF THE LICENSEE

The main responsibilities defined by the National Commission on Nuclear Safety and Safeguards, to be satisfied by the Federal Electricity Commission (owner of Laguna Verde NPP), are contained in the conditions of the License for Commercial Operation of each of the Units of the Laguna Verde Nuclear Power Station. Additionally and as an integral part of the Commercial Operating License of LVNPS units 1 and 2, the Tecnical Specifications were emitted which contain the limiting conditions of operation, verification of operability and immediate actions that the license holder must adopt.

Regarding the nuclear safety of Laguna Verde's Nuclear Power Station Units-1 & 2, CFE's responsibility, through the Nuclear Power Plant's Division, is recognised and observed in the Quality Assurance Plan of the Operation Organisation detailed in Article 13 of this National Report.

The Quality Assurance Plan of the Operation Organisation for Units 1 & 2, includes measures that permit to ensure the establishment of an appropriate organisation by CFE in order to execute each and every one of the important safety activities performed within Laguna Verde's Nuclear Power Station during the operation of Units 1 and 2.

According to the aforementioned and as established in Section 1.2.1 of the Quality Assurance Plan of Laguna Verde's Nuclear Power Station Units-1 and 2, the General Director of CFE is responsible before the CNSNS for conducting safe operation and design modifications to Laguna Verde's Nuclear Power Station Units-1 and 2 in accordance with the directives established within the Regulatory Framework, Operation Licenses, Technical Specifications of Operation and Quality Assurance Plan.

9.3 MEASURES ADOPTED BY THE REGULATORY BODY TO ENSURE THE FULFILLMENT OF THE LICENCEE'S RESPONSIBILITIES.

The CNSNS, as the National Regulatory Body, has established several mechanisms to guarantee that the licensee satisfies each one of the items related to the obligations acquired through the license. To this effect, audits, surveillance's, inspections and periodic assessments of all important activities at LVNPS-1 & 2 are carried out following an annual program.

The program of inspections and audits is based on the importance of the activities performed by the primary responsible, the facility's behaviour and the personnel taking part in previous audits and inspections, the number and amount of findings raised by the Regulatory Body as well as by internal instances of control.

Multiple disciplinary engineer-inspector groups are formed to carry out inspections. Each inspection or audit takes a period of one to two weeks. Among other areas of interest, the following have been examined: administrative controls, instrumentation and control, fire protection programs, environmental equipment qualification, reactor engineering, radiation protection programs, spare parts, purchasing of articles and services, in-service inspection, pump and valve operability programs (in-service testing), personnel qualification programs, and surveillance's of Technical Specifications fulfilment.

Another mechanism by which the Mexican Regulatory Body verifies that CFE complies with the safety obligations established in the operation license is, the design modification assessment process as well as operational events and safety improvements result of the application of operational experience. These assessments lead to a frequent interrelation between CNSNS and LVNPS; the agreements resulting from the meetings and assessments performed are documented in an appropriate manner and on occasions mandatory technical compliance positions are generated.

Additional information on CNSNS responsibilities and duties as well as specific activities to verify that CFE assumes its responsibility as regards to safety are described in Articles 8 and 11 of the National Report.

ARTICLE 10. PRIORITY TO SAFETY

10.1 INTRODUCTION AND SAFETY POLICIES

As regarding priority to safety, Articles 19, 20, 21, 28, 32, 34, and 50 of The Regulatory Law of the Constitutional Article 27 on Nuclear Matters establish that of all installation activities performed by the licensee, including planning, design, construction and operation as well as definitive shutdown and decommissioning, safety always has the highest level of importance.

In Mexico, nuclear safety has three main objectives.

a) To ensure that nuclear installations operate normally without excessive risks for personnel on the facility, the population and the environment.

b) Prevent incidents, and

c) Mitigate consequences of any incident, if it was to occur.

This leads to the general purpose of nuclear safety, which is to protect man and environment, limiting radioactive material releases under any circumstance. In other words, ensuring the confinement and control of such materials.

To manage the safety, in conceptual terms, two strategies are applied to prevent and control radioactive material mobility, especially when incidents occur:

i. Provision of “non-leakage” barriers between the radioactive source and the public. These barriers are four: fuel cladding, reactor coolant pressure boundary (includes reactor vessel), primary containment and secondary containment (reactor building).

ii. Application of the concept of Defense in Depth (DID) to both design and operation of LVNPS-1 & 2. This concept consists of three levels as detailed in Section 18.3 of this National Report.

Additionally and as an extension to the concept of DID, there is the external radiation emergency plan in the event of accidents beyond design basis. According to probabilistic safety analysis results, these accidents have a very low probability of occurrence.

10.2 SAFETY CULTURE AND GOOD PRACTICES

CFE, as proprietor of LVNPS, is a member of several International Organizations that seek to interchange experiences to improve the safe operation of nuclear installations. Among these organizations are INPO ("Institute of Nuclear Power Operations"); WANO ("World Association of Nuclear Operators"), and BWROG ("BWR Owners Group"). Additionally, Mexico is part of the International Nuclear Event Scale (INES), and of the Incident Reporting System (IRS).

Below are some good practices, among others, recognized by OSART (Operational Safety Assessment Review Team) personnel OSART visited LVNPS in 1997.

- LVNPS Emergency Action Levels (EAL) are based on NUMARC NESP-007. It includes an excellent description of the basis of each one of the Emergency Action Levels. Personnel are trained on such document, producing as a result, a reduction in deviation during emergency classifications.
- LVNPS has developed flow charts used during the application of the Emergency Plan that eliminate the potential error of consulting different documents during tense situations.
- Constantly, CFE and Regulatory Body maintain good communication as well as an agile and open flow of information.
- LVNPS observes good housekeeping.
- Within the Emergency Operation Procedures (EOP´s) the flow charts have reference to the Emergency Action Level (NAE´s).
- The application of the Probabilistic Safety Analysis (PSA) and Job and Task Analysis that include Human Factors allow performing a more detailed analysis, complementing the deterministic analysis.
- Setting up of the Operational Review On-Site Committee (CROS) as ALARA Committee.

The original mission as well as follow up meeting (October 1998) emphasized the need to reinforce the safety culture at all levels was; since then, many activities have been developed with the object of improving the comprehension of the safety culture in accordance with the document by the International Safety Advisory Group, INSAG-4.

In response and as a first step, CFE's Nuclear Power Plant Division (GCN) re-oriented its policy to emphasize that nuclear safety is before production of electricity and developed in August 1998 the Safety Culture Program.

This was clearly established in the organization's Mission issued in November 1999 and that continues to preside. It states: *"To generate electricity by nuclear means with quality and at a minimum cost, with safety as the highest priority, sustained by our personnel's continuous self-improvement and deep respect to the environment".*

ARTICLE 11. FINANCIAL AND HUMAN RESOURCES

11.1 FINANCIAL RESOURCES

In accordance with Article 74, Fraction IV of the Political Constitution of the Mexican United States, annually the Federal Executive (President of the Republic) submits to the consideration of the Honorable Congress of The Union for approval, a governmental expenditure budget project for the fiscal year to come.

11.1.1 Financial Resources for CNSNS

CNSNS, as a semiautonomous organism, prepares its budget annually through the Finance and Administration Unit, based upon specific needs identified by its different departments and areas.

The CNSNS budget comes entirely from federal funds, assigned as part of the total budget of the Department of Energy.

For details about the financial resources of the CNSNS. (See Section 8.4.2 of this National Report).

11.1.2 Financial Resources for CFE

CFE, reporting to the Department of Energy, is the decentralized public entity in charge of producing, transmitting and distributing electric energy throughout the country.

CFE is a public sector enterprise, for this reason, it is assigned a budget that must be used adequately and in a transparent manner. Part of the CFE budget, the investment and operation costs are privileged with respect to the rest of the installations. This has succeeded in part due to the requirements imposed by the Mexican Regulating Body.

Annually, the different divisions of CFE prepare their budgets in order to comply with provisions established in programs for development committed to by the entity.

In particular, LVNPS, as an autonomous unit, prepares its annual budget based upon specific needs identified by its different sub-managements and department and areas. Such identification is carried out based on plans established for refueling outages, maintenance and continuous improvement on both LVNPS units.

Once budgets are approved, the General Direction of CFE through its financial authorities distributes the resources assigned to each autonomous Sub-direction and Divisions, giving priority to LVNPS.

11.2 HUMAN RESOURCES

11.2.1 Human Resources for CNSNS

See Section 8.4 in this National Report for information regarding to human resources for CNSNS.

11.2.2 Human Resources for CFE/GCN

11.2.2.1 Organizational Structure at CFE

CFE is a decentralized public entity having its corresponding legal capacity and inheritance. Its objective is, among others, to render electrical power public services under terms and in compliance with Article 4 and 5, respectively of the Law of Electrical Power Public Services.

The CFE is ruled by a Board of Governors formed by the Department of Treasure, Department of Social Development, Department of Natural Resources and Environment, and the Department of Energy (who preside this Board). Also, the General Director of the Mexican Petroleum Company (PEMEX) and three representatives of the National Electricity Workers Union are part of the Board of Governor.

The Board of Governors has, among others, the responsibility to approve the programs and budgets of CFE and the modifications proposed, as well as establish policies and priorities to which CFE must abide.

CFE is the owner of LVNPS and through its Nuclear Power Plant Division (GCN) takes on complete responsibility for its design, engineering, construction, operation, maintenance and decommissioning.

11.3 TRAINING AND RETRAINING PROGRAM

The Training Program for LVNPS-1 & 2 personnel is based on three programs:

a) Initial Training Program

b) Retraining Program

c) Replacement/Substitute Training

Appropriate personnel are obtained through these three programs, in number, qualification and training for the different functions and responsibilities.

11.3.1 Initial Training Program

Training of licensed personnel is developed based upon CNSNS standards and requirements to ensure the availability of qualified personnel to operate LVNPS. Training of personnel whom do not require to be licensed is implemented based upon specific area needs.

11.3.1.1 Training of Licensed Personnel

Basically, training for personnel requiring a license from CNSNS is designed for candidates who have never received previous formal nuclear station training.

This program is formed by the following phases:

a) Introduction to Nuclear Power Plants (Selection)
b) Laguna Verde Orientation
c) Basic Nuclear Course
d) BWR Technology
e) BWR Simulator Training
f) Course on Observation
g) Core Damage Mitigation
h) Transient Analysis
i) Heat Transfer, Fluid Flow and Thermodynamics.
j) Refueling Training Activities
k) License Preparation Review
l) Nuclear Plant Engineering
m) On the Job Training

Training initiates with the integration of personnel to routine activities as candidates to the corresponding active position upon finalizing their initial training. It concludes obtaining the license (reactor operator and senior reactor operator or instructor certificate).

In addition to the fulfillment of the aforementioned program, licensing personnel are submitted to training at the full scope LVNPS simulator.

The simulator course consists of seven to twelve weeks of theory and 120 hours of practice in the simulator control room. This course was designed to provide inexperienced BWR operator and senior operator license candidates the skills required for operating Laguna Verde's nuclear reactor in a safe and efficient manner. Experienced training instructors impart theory and practice to the candidates,

suggesting on a daily basis lecture and study assignment. Written and oral tests are applied to monitor candidate progresses. During practices at the control room simulator, candidates are rotated on the different control room positions, including the Shift Supervisor position; in this way, all candidates have equal opportunity to perform evolutions from each operation position.

CNSNS verifies the licensing process of LVNPS personnel through inspections of the Training Center, at least once every two years, which include but are not limited to the following:

1. Revision of the operational experience of the installation to verify the important errors of licensed personnel, detected en the last inspections/ evaluations or examinations, in order to determine if they are due to weaknesses or rather to lack of effective training.
2. Revision of the re-qualifying exams prepared by LVNPS to evaluate their suitability and the eventual necessity to require operational and written exams in addition to those already prescribed.
3. Revision of the practices utilized by LVNPS during the application of the re-qualifying exams (operational and written exams).
4. Revision of the backfitting of experience used by LVNPS during training to evaluate the effectiveness of the process of revision and evaluation of the Continuous Training Program.
5. Revision of the implementation of the best proposals by LVNPS or required by CNSNS for the Training Program, as a result of the failures detected by both; as well as follow up of the requirements from previous evaluations.
6. Revision of the compliance with the Operator's License Conditions to maintain the license valid and the assurance of the health conditions of the operator in accordance with 10 CFR 55.

11.3.1.2 Training of Non-Licensed Personnel

Training for LVNPS personnel not requiring a CNSNS license is classified into three levels:

Level A – Directors and Supervisors

Level B – Technicians

Level C -- Others from maintenance, substation and calibration.

11.3.2 Retraining Program

11.3.2.1 Licensed Personnel

Retraining of licensed personnel initiates one month, to the latest, after CNSNS awards the license. It is carried out in a continuous two-year cycle manner to maintain the validity of the license.

11.3.2.2 Non-Licensed Personnel

Retraining of non-licensed personnel is developed based upon their specific responsibility needs, including recommendations from Radiation Protection, ALARA and Emergency Planning areas.

11.3.3 Substitute Program

The objective of this program is to train personnel that will entitle a job position, once satisfied educational, experience and health requirements. In this way, substitutions at least satisfy the same requirements of personnel to substitute.

ARTICLE 12. HUMAN FACTORS

12.1 BACKGROUND

As a result of the accident at Three Mile Island Nuclear Power Plant in 1979, the USNRC published the document NUREG-0660, and later on NUREG 0737 and its Supplement No. 1. These documents required a detailed revision be performed as regards to the design of control rooms (item I.D.1) at nuclear power plants in operation and under construction as well, to be equipped with a Safety Parameter Display System (SPDS) (item I.D.2) in order to improve the operator-process interface, and this way, reduce the probability of occurrence and the severity of the operator's errors as well as to help them in their decision-making during anomalous and emergency conditions.

Something to be considered as a positive situation in relation to LVNPS' delay in going into operation is that it allowed for time to identify and establish the operating programs for resolving the requirements observed in NUREG-0737 and its Supplement No. 1 before its start-up. Also, it allowed time to fulfil one of the requirements to authorize the continuation of the construction at a stage previous to the Laguna Verde start-up, in which the Regulatory Body established the following:

"To date, Laguna Verde Nuclear Power Station has performed the control room inspection identifying instrument discrepancies and/or details in the arrangement of the instruments. Most of these discrepancies have been corrected; however, some things remain pending for this case to be closed. CNSNS established the date for closing the remaining matters to be the day of the plant's first refueling outage. Given that the inspection must be permanent in order to continuously update the main control room, CFE shall present to CNSNS a continuous evaluation program".

12.2 SITUATION

CFE issued the CLV-1 "General Control Room Design Review Plan". Upon completing the activities considered in the plan, CFE forwarded the report titled "Control Room Design Review Report for Laguna Verde Nuclear Station Unit 1" to CNSNS in compliance with the requirement established in 10CFR50.34(f)(2)(iii).

In order for LVNPS-2 to satisfy the requirements in NUREG-0700 and NUREG-0801 and being that Unit 1 and 2 are of an identical design, except for a few very punctual differences, an activity plan consisting of two phases was agreed for this unit.

During the first phase, all changes were performed in Unit 1, meanwhile during the second phase, all specific differences between what was installed in Unit 1 and 2 control

rooms were identified. Based on this, inspections were performed in accordance with the documents cited.

During the second phase, Task Analysis of the Emergency Procedures was carried out and exercises were performed with Unit 2 shift personnel by developing scenarios at the Simulator located at LVNPS' Training Center.

In order to be able to fulfil the activities in the second phase, CFE issued and submitted to CNSNS, the "LVNPS-2 General Control Room Design Review Plan (RDDCC)".

Additionally, CFE has been carrying out a systematic execution of reduction program for alarms presenting problems in order to achieve the "Black Board" Condition, in where a list of alarms was determined to operate inadequately from the original design of Units 1 & 2. CFE carried out the design modifications required to eliminate the alarms having problems in accordance with the program established. This issue began since the startup stage in both LVNPP Units due to configuration problems and it was show through malfunctioning of alarms.

As part of the improvements introduced to the design since the LVNPS-1 & 2's start-up, there is a Safety Parameter Display System in each unit's control room that is a part of a system which is used to monitor all process parameters (Process Data Integral System). This system allows the operator to have an actual vision as well as a retrospective vision of the behavior of the most important process parameters, allowing appropriate decision-making and reducing possible errors.

In addition, as part of the Internal and External Operational Experience programs, the identification of human error as a root cause or accident contributor has been particularly considered; thus, in those cases in which this is identified as such, recurrence of the same is to be prevented by the corresponding corrective actions, trying to reduce human error as much as possible. Article 19 of this National Report provides details regarding to the application and scope of the Operational Experience Programs.

The Nuclear Power Plant Division implemented, in the period 2003-2006, the Plan for Recovery and Development, which was a main strategy for the improvement in performance at LVNPS. The expectations and performance goals for personnel, equipment, processes and organizations of the Division were established in this plan.

This plan contains eight focus areas:

1.- Leadership and management

2.- Communication and teamwork

3.- Resources

4.- Human performance

5.- Self assessment and corrective action

6.- Condition of materials and plant reliability

7.- Reduction in generation loss

8.- Optimization of dose

12.3 FURTHER STEPS CONTRIBUTING TO PREVENT HUMAN ERROR AND IMPROVE MAN-MACHINE INTERACTION

Special attention was paid to Focus Area No. 4 Human Performance, from section 12.2 of the Annex II. The use of tools to prevent errors is the way in which the Nuclear Power Plant Division (GCN) improved the man-machine interaction, the processes, teamwork and training.

To take on this Focus Area various specific initiatives were developed which were conceived in order to support management processes, programs, procedures and the performance of all personnel of the GCN organization.

Among these initiatives it is important to point out the following:

- Quality culture improvement
- Personnel Performance improvement
- Increased Safety and health for personnel at work.
- Establish, disseminate and implement the Human Performance Program.
- Establish, disseminate and implement strategies to improve the Safety Culture.
- Continue with the use of Information Systems in the development of the managerial data base

The Human Performance Area was formed to provide support to that related to human performance and error prevention at LVNPS. Their objective is to promote knowledge about Human Performance Principles and its application in activities at the station, based on a proactive attitude to prevent errors in order to reach a safe and reliable performance.

Level 1 and 2 PSA (Probabilistic Safety Analysis) results and the analysis of human reliability which has permitted to identify accident sequences where the human factor has a major contribution to the core melt frequency. The application of these results as regards to this particular topic has been through the reproduction of dominant sequences in LVNPS' simulator to train and test appropriate operator responses.

In addition, and within what may be considered as a LVNPS good practice related to human performance, the following operative aids have been implemented:

- There are procedures to handle operational transients and accidents based on symptoms, including flow charts and operational support devices to allow the operators an adequate response in this kind of events.
- The Safety Parameter Display System (SPDS) was installed as part of the simulator and the training was prepared for its use under anomalous or emergency conditions.
- Use of self-assessment an self-checking verification card (golden card)
- Since 2000 there is an special group to perform the root cause analysis
- Since 1999 the Systematic Approach to Training was incorporated for the training of LVNPS personnel.
- Since 1998, yearly the Independent Safety Engineering Unit (UIIS) carries out an assessment of the CFE/GCN directive staff performance, to identify improvements needed in human performance.
- Since 1998, personnel from the different functional areas of the Nuclear Power Division and in particular from the LVNPS (operations, maintenance and engineering support), have been trained on human performance principles and on Conservative Decision Making
- Also, almost all the permanent personnel have passed the courses on defense in depth principles, among others, as part of the Safety Culture Reinforcement Program.

12.4 THE ROLE OF THE REGULATORY BODY IN REDUCING EVENTS CAUSED BY HUMAN FACTORS

In order to guarantee that the requirements for minimization of human factors in the operational events are part of the operational philosophy, CNSNS has imposed two requirements to maintain the operating licenses:

2. "*LVNPS simulator must fulfil the requirements of fidelity in response and reliability of working. Furthermore, this simulator must have the Safety Parameter Display System (SPDS).*

Additionally, LVNPS must review and verify the lessons and scenarios in order to minimize the errors in the personnel training and to achieve a more complete training.

The instructors (in any discipline) must be actualized in the current technologies, considering the current national and international technologies."

6. "*LVNPS must continue and conclude, during the present year 2000, the Alarm Reduction Program in the main Control Rooms, establishing the needed changes to design*".

Since 1999, the Regulator implemented a system for the evaluation of human performance whose main objective is to identify and correct the causes that induce human error. This methodology evaluates aspects such as: environmental conditions, interface with the design or condition of the equipment, verbal and written communication, methods for training / qualification of personnel, work planning and practices, methods for supervision and administration. As a result of this methodology there was improvement in the process of the LVNPS main control room design review and a greater dissemination of concepts on safety culture and self-verification was required.

The regulator evaluated the impact of the organization and the administration on safety at LVNPS in order to identify the influence of the organizational factor on human performance.

ARTICLE 13. QUALITY ASSURANCE

13.1 QUALITY ASSURANCE POLICIES

LVNPS Quality Assurance Policies are as follows:

- All design, construction and operation activity related to structures, systems and components important to safety must be conducted under strict management and administrative controls to ensure that the operation of LVNPS Units -1 & 2 does not cause an undue health and public safety hazard.

  These controls consist of planned and systematic actions that guarantee the adequate accomplishment of activities related to design, purchasing, fabrication, handling, shipping, storage, cleaning, assembling, installation, inspection, testing, operation, maintenance, reparation, refueling outage and changes, are realized in such a manner that the structures, systems and components important to safety, have to perform satisfactorily in service.

- The activities above mentioned are to be performed by adopting approved procedures as well as by duly qualified trained personnel.

- Duly qualified personnel alien to activities under control must perform the actions of control.

CFE, represented by its General Director, holds the total responsibility for the implementation of the Quality Assurance Program through the Manager of the LVNPS Nuclear Power Plant Division (CFE/GCN), who in turn delegates the responsibility for the development, verification and control of its effective execution to the Quality Assurance Department. In order for the Quality Assurance Head to be able to carry out his responsibilities in an efficient and opportune manner, he has sufficient organizational authority, freedom and support from the Nuclear Power Plant Division (GCN) as well as from the General Direction observed through an alternate line of authority.

Four categories were settled as part of the Quality Assurance Program. These four categories define the required Quality Assurance effort for structures, systems and components, as well as towards suppliers, service contractors, in terms of the importance such components or services have as regards to safety.

Quality Assurance (QA) Categories

QA-1 Category:

Assigned to components, subsystems, systems, structures, processes and services requiring the highest level of reliability in their functioning. It applies to components of the reactor coolant pressure boundary and core support structures wherein a failure may cause loss of the reactor coolant at a greater rate than the normal capacity of the back up water system.

QA-2 Category:

Classification assigned to structures, systems, subsystems, components, processes and services required to:

- Insert negative reactivity for shutting down the reactor.
- Prevent rapid insertion of positive reactivity.
- Maintain appropriate core geometry under any plant process condition.
- Provide emergency core cooling.
- Provide and maintain the containment.
- Remove reactor and core residual heat.

QA-3 Category:

Classification assigned to components, subsystems, systems, Class 1E equipment, structures, processes and services that:

- Provide or support any safety system function.
- Process or contain radioactive waste whose release in the event of a component failure may cause a person within the limits of the site, a whole body dose or its equivalent in any part of the body, greater than 5 mSv.

QA-4 Category:

Classification assigned to components, subsystems, systems, structures, processes and services which do not have a safety function assigned, but are Seismic I Category. It also applies to supports that do not have a Seismic I Category, but are designed in such a manner to not harm seismic or safety-related components upon failure.

Two additional categories were defined, and partial fulfillment of 18 Quality Criteria in 10CFR, Appendix B were set, in order to maintain a very high level of quality in other

systems necessary to comply with the objectives of minimizing fire risks and radioactive waste control. These categories are:

QA-SPCI Category:

Classification assigned to fire protection components that do not belong to SSEFPS (*Safe Shutdown Earthquake Fire Protection System*), but are used to protect areas containing QC category equipment.

QA-RW Category:

Classification assigned to process equipment, pipes and valves that are not Class 1, 2 or 3, but form the radioactive waste pressure barrier.

The six quality categories include the application of quality principles to equipment and components in which the function is: to maintain the structural integrity of the coolant pressure boundary, control essential functions (reactivity, core cooling, containment integrity) and handling of radioactive waste (in which a failure would produce doses greater than 5 mSv).

13.2 QUALITY ASSURANCE PLAN DURING THE CONSTRUCTION STAGE

The Quality Assurance Plan during the construction stage constitutes Section 17.1 of the Final Safety Analysis Report, it was applied to all participants of the plant performing structure, system, equipment, component or service safety-related activities, during its design, procurement, fabrication, construction, handling, storage, shipping, cleaning, assembling, installation, inspection, construction tests, maintenance, repairing and commissioning stages.

13.3 QUALITY ASSURANCE PLAN DURING THE OPERATIONAL STAGE

During the operational stage of LVNPS Units-1 & 2, the execution of activities important to safety is ruled by the Quality Assurance Operation Plan. It was designed to meet the requirements established in 10 CFR 50, Appendix B, in accordance with the regulatory framework required for LVNPS' licensing. The Quality Assurance Operation Plan includes as a method for achieving its implementation of a set of procedures comprising all activities covered in the Plan; these procedures are revised every two years.

The Quality Assurance Operation Plan describes the Quality Assurance requirements and controls to be applied to LVNPS Units-1 & 2 during its useful life, including decommissioning. Apart from the scope established within the Quality Assurance Construction Plan related to the four categories (plus fire protection and radioactive

waste), the Quality Assurance Operation Plan has a more extended scope, as it covers the Technical Specifications as well as the External Radiation Emergency Plan.

13.3.1 Periodic Evaluation of the Adequacy of the Quality Assurance Operation Plan

The Nuclear Power Plant Division in compliance with the Condition 12 of the Operating Licenses for LVNPS 1 and 2, through independent and qualified personnel, evaluates at least every two years the effectiveness of the Quality Assurance Operation Program and evaluates the performance of the GCN directive group, and reports the results to CFE's Manager of the Nuclear Power Plant Division.

Since 1998, these assessments are carried out by the Independent Safety Engineering Unit, which reports directly to the Manager of the Nuclear Power Plant Division and is totally independent from all the functional areas of the same Division, including the Department of Quality Assurance. Basically its objective is to verify that the Quality Management is effective in assuring safe and reliable operation, and to determine what improvements are required to promote successful operation.

The determination of the Quality Assurance effectiveness is based on the revision of the following:

Review and Evaluation:

- Performance Indicators. - Data of equipment and organizational and individual personnel performance.
- Non- performance Indicators. - Related to conditions adverse to quality.
- Audits and review results.

Identification of Symptoms that signal shortcomings on:

- Failure to effectively assign responsibilities and authority.
- Inability to anticipate, identify and correct own problems.
- Failure to achieve and maintain quality culture.
- Failure to optimize the use of key resources.
- Inadequate interfacing between organizations.
- Inability to focus on long-term performance.

13.3.2 Audits and Surveillances

The Quality Assurance Operation program includes measures for establishing and executing a planned and periodic audit and surveillance system to verify the adequate implementation of program requirements by all organizations responsible for the rendering of services required. Audits include an objective evaluation of practices, procedures, instructions, activities and items as well as documents review and records important to safety to ensure that the Quality Assurance Program is implanted in an appropriate and effective manner. Both the Quality Assurance Organization and the Quality Control Organization of LVNPS perform surveillances.

LVNPS has established a policy that the maximum time interval between audits for the same functional area is two years. However there are areas that require more attention due to the quality of findings or recurrent problems and could be audited more frequently than once every two years.

13.3.3 Corrective Actions

The Quality Assurance Operation Program establishes measures to ensure that adverse quality conditions identified are promptly controlled, analyzed, corrected, and according to their grade of importance, revealed to the appropriate high levels of management.

Presently, LVNPS is applying a Corrective Action Program (PAC), which is similar to that used at several plants in the USA. This program implies diverse changes in work strategies and methods, and will control all the corrective actions assigned to adverse conditions to quality.

13.3.4 Procurement of Parts and Components

CFE's Quality Assurance organization qualifies to all the suppliers of the important to safety equipment, components and services for LVNPS. This qualification can be made by direct evaluation of the vendor / supplier quality programs and its implementation or through the Nuclear Procurement Issues Committee (NUPIC) from which CFE is a member. The qualifications are in general based mainly on the ANSI/ ASME N 45.2.12 "Requirements for auditing the Quality Assurance Programs for NPP".

13.4 REPORTING SYSTEM

A utility - Regulatory Body interface has been established by means of a report system based on regulations above mentioned. These reports are classified as follows:

REPORT	APPLICABLE REGULATION
Defects in Components	10 CFR 21
Important Deficiencies (IDI's)	10 CFR 50.55(e)

The Quality Assurance Department manages the Reporting System.

Reports of defects in components correspond to non-conformances in the component/equipment design and fabrication phases, which affect performance. Normally, these are exterior to the owner of the plant and are generated for manufacturers and suppliers of equipment and components important for safety, except for commercial grade equipment and components purchased by the owner and dedicated for nuclear use.

The "Important Deficiency" Report corresponds to an important break to the Quality Assurance Program and despite that the original regulation is only meant for the construction phase, the owner of the plant and the Regulatory Body have determined to maintain it during the plant's operation stage.

13.5 REGULATORY BODY ACTIVITIES FOR NUCLEAR INSTALLATIONS

CNSNS has reviewed and approved each one of the versions issued for the Quality Assurance Plan, during construction and operation stage.

ARTICLE 14. SAFETY ASSESSMENT AND INSPECTION

14.1 INTRODUCTION

CNSNS has requested to Laguna Verde Nuclear Power Station a number of analyses in order to prove it satisfies all safety requirements. Although, it has already been established in previous sections within this Report, it is important to mention that the methodology followed for licensing the plant was that of the format of the reactor's country of origin (United States of America). That is, two authorizations: one for the construction stage which finishes with the issuance of the Construction Permit and another where the scope covers the portion of pre-operational and start-up testing that concludes upon granting of the License for Commercial Operation.

Even though there are other intermediate and posterior stages to these two events, such as the authorization for dismantling the facility or the license to construct peripheral installations for the temporary storage of radioactive waste, this portion of the report shall describe only assessments performed within LVNPS' Construction Permit and License Operation stages.

The LVNPS was originally licensed on July 24, 1990, with 1931 MWt thermal power. Unit 2 was licensed April 10, 1995 with the same thermal power as Unit 1.

In the second half of 1995, CFE started the preliminary negotiations regarding a 5% uprate in the thermal power for both units of Laguna Verde NPP. In 1999 CFE presented the official application for the mentioned uprated power. After the review of the safety analysis report and documentation submitted as support of this application, CNSNS approved a testing phase program in order to verify the LVPNS units stable behavior under this uprate condition. Based on the successful results and on the CNSNS favorable opinion, in December 8, 1999, CFE received from the Department of Energy the new Operation License for both units of LVNPS for a power uprate of 5%, that is to 2021 MWt.

In this Article the safety evaluations and verifications performed by the Regulatory Body and other organizations external to LVNPS are described. Also, the evaluations performed employing probabilistic safety analysis techniques are described. These evaluations and verifications have resulted in a set of activities to improve the safe performance of the installation and are described in this Article as well.

14.2 SAFETY ASSESSMENT-CONSTRUCTION STAGE

In accordance with the normative and prior to construction, CFE presented to the Department of Reactors of the National Institute for Nuclear Energy (INEN) (identified at

that time as the "Regulatory Authority") in 1973, a safety analysis corresponding to: the Preliminary Safety Analysis Report, Preliminary Environmental Impact Report and Quality Assurance Construction Program.

During this period, LVNPS was submitted to diverse evaluations, inspections and audits as part of the licensing process. These activities were performed by the Regulatory Body and organizations of the plant as well as independent technical auditors.

14.2.1 LVNPS Internal Audits/Inspections

The Quality Control and Quality Assurance Departments carried out such audits. Activities of both organizations were performed in a continuous manner and under a specific program during the activities of design, construction, purchasing, procurement, shipment, etc.

14.2.2 Regulatory Activities Performed by CNSNS

For the Construction Permit to be awarded, CNSNS evaluated the Preliminary Safety Analysis Report (PSAR). Eight hundred questions were generated from this, resulting in the issuance of 44 amendments to the PSAR.

The process of evaluation allowed for of several Provisional Construction Permits to be awarded, the Definite Construction Permit for LVNPS was awarded in 1979. Later, in September 1992, an extension to such Definite Permit was issued specifically, for completing the construction of LVNPS-2.

During the construction of LVNPS-1 & 2, CNSNS performed inspections and surveillances to activities of design, engineering, installation, special processes and non-destructive testing. Similarly, following a continuous and systematic program, CNSNS performed audits and inspections to the main suppliers of services and equipment important to nuclear safety.

In addition to the aforementioned activities, resident inspectors were assigned to the construction site. In order to carry out some of these assessment activities, the IAEA provided technical assistance to CNSNS through experienced personnel.

14.2.3 External Assessments

There were three IAEA missions through the Operational Safety Evaluation Groups that were conducted in January 1986, January 1987 and September 1987. In addition, there was a mission carried out by the Radiation Protection Consulting Team in December 1986. There were no substantial defects in the safety systems of LVNPS reported, including administrative and quality assurance systems

14.2.4 Pre-operational Test Program

The preoperational test program initiated with the transfer of systems and components from the construction organization to LVNPS operation personnel. As of the date of assessment of this program, CNSNS developed a work plan which among other activities, included: evaluation of safety-related test procedures, witness tests and evaluation of test results.

14.3 SAFETY ASSESSMENT, OPERATION STAGE

CFE, on June 29 of 1979, submitted to CNSNS a Final Safety Analysis Report (FSAR) to support the application for the License for Commercial Operation of LVNPS-1. In view of the differences between units, a separate FSAR was submitted to CNSNS for LVNPS-2 and such differences were analyzed, finally its License for Commercial Operation was awarded in 1995.

As indicated in Section 14.1 of this Annex II, from November 1995 to March 1999, CFE presented to the Regulatory Body (CNSNS) the project and request to change the License for Commercial Operation and the Technical Specifications of both LVNPS units. This request was presented in order to increase the original thermal power by 5%, based on the increase in steam flow, maintaining the original internal pressure in the vessel steam dome.

14.3.1 Evaluations/Surveillance by LVNPS Organizations

(a) Audits and safety evaluations in a independent character from the Production organizations are carried out in strict accordance with the directives in the Quality Assurance Operation Plan, Independent Review Program and Technical Specifications of LVNPS-1 & 2. The participating organizations are as follows:

- Quality Assurance: Quality Assurance audits are performed under a regular and systematic program involving all activities important to safety. The scope of audits includes all technical areas of LVNPS: Production, Technical Support and Engineering.

- The Independent Operations Review Committee (CIRO) is responsible for the following evaluations and audits:

    1. To evaluate that a change or modification to a system or procedure does not constitute an Unreviewed Safety Question (USQ); changes to Technical Specifications and reports of events occurring at the station, among others.

2. Audits contemplated under the responsibility of this Committee include those related to compliance with conditions of the License for Operation, preparations and execution of the Emergency Plan, the capability of response provided by the Physical Safety Program, Fire Protection Program (Independent) and Environmental Radiological Surveillance Program, among others.

During these evaluations and/or audits, deficiencies and deviations are documented as findings, establishing their follow-up and adoption of corrective actions until their closure.

(b) As part of the modification process, compliance with 10CFR50.59 "Changes, Tests and Experiments" is required. This rule has the following objective:

- To permit licensee to perform modification to the installation as described in the Final Safety Analysis Report (FSAR)
- To permit licensee make changes to procedures.
- Carry out tests or experiments not described in the FSAR without previous approval of CNSNS, unless the activity involves a change to Technical Specifications or results in an USQ by the Regulatory Body.

Periodically, the licensee must submit a report to CNSNS containing summaries of the evaluations of all activity implemented at LVNPS without previous approval of the Regulatory Body. By means of this methodology of evaluation, the following is assured:

- Modifications performed without previous approval of CNSNS are in compliance with the bases with which LVNPS-1 & 2 were evaluated for the awarding of Licenses for Operation.
- Technical Specifications are not modified.
- FSAR is maintained up to date.

These 10 CFR 50.59 safety evaluations are reviewed and approved by the Nuclear Safety Department of LVNPS.

The different types of modifications are the following:

PM- Modification Package

PMM- Minor Modification Package

PMMD- Minor Documentary Modification Package
PERC- Component Replacement Evaluation Package
PMDT- Technical Documentary Modification Package
PCPA- Set Point Change Package
PyD- Jumper and Disconnection
PROC- Procedures
PMRC- Component Replacement Modification Package
SMT- Temporary Modification Request
ESPEC- Design Specifications

14.3.2 External Evaluations/Verifications to LVNPS

14.3.2.1 External Evaluations/Verifications Performed by CNSNS

A) Start-up Tests

Just like for the pre-operational stage, prior to Initial Nuclear Fuel Loading in October 1988 for LVNPS-1 and June 1994 for LVNPS-2, CFE presented a start-up generic test program in order to demonstrate that LVNPS-1 & 2 can handle foreseen transients with sufficient safety margins during its operational lifetime. In this respect, CNSNS developed a work plan including among other activities: evaluation of test procedures for safety-related systems, witness of tests and evaluation of test results.

B) Commercial Operation

The CNSNS performs activities in order to monitor that operation of LVNPS does not cause undue risk to the health and safety of the public are: Assessment, Inspection, Licensing of Nuclear Installations, Licensing of Operators and Enforcement measures.

Assessment:

The main activities of assessment by CNSNS:

- Review of Technical Specifications based on international operational experience.
- Proposal of changes to Technical Specifications or to the License for Operation.
- Results of Pump & Valve Operability Programs (In-Service Testing) under ASME Code, Section XI.
- Results of In-service Inspection Programs under ASME, Section XI for active and passive components.
- Licensing of reactor cores for each fuel cycle.

- Assessment of Reportable Events that are delivered to the Regulatory Body.
- Assessment of control and maintenance of ageing (programs for maintenance of environmental qualification, corrosion, reactor vessel material surveillance due to neutron irradiation, water chemistry) and structural integrity.
- Assessment of the applicability of Internal and External Operational Experience.
- Assessment of design modification to systems, structures and components important to safety.
- Review of test and experiments to be performed al LVNPS.
- Review, development, and implementation of new regulations.

An important assessment effort since the date when the original License for Operation was granted for each unit of the LVNPS, has been the evaluation of the request to uprate the thermal power by 5%.

The assessment covered almost all topics addressed in the FSAR including: Reactor Core and Fuel Performance, Reactor Coolant System, Engineered Safety Features, Instrumentation and Control, Electrical Power and Auxiliary Systems, Power Conversion Systems, Radwaste Systems and Radiation Sources, Design Basis Accidents, Environmental Qualification, Start up and Testing Program, etc.

Based on the assessment results, CNSNS authorized the testing phase program. Furthermore, CNSNS witnessed the entire test during the power increase in 1% steps. Finally, it was established by CNSNS that these tests were satisfactory and that the systems performed adequately.

The assessment process generated 55 questions to CFE and 39 technical meetings, and the Technical Specifications were modified due to this increase. In general terms, CNSNS confirmed that it was not necessary to implement any physical change to the structures, systems and components of LVNPS 1 & 2, due to this power increase.

The results of the assessments and inspections were documented in a Safety Evaluation Report which served as a basis to recommend to the Department of Energy (SENER) the modification to the original Operation Licenses from 1931 to 2021 MWt.

Another important activity was the evaluation of the Application for a License Change, to modify the range of total flow through the core from (87-107) % to (81 -107) %. This change is known as Operational Flexibilities.

This evaluation included, among others: transient analysis, overpressure protection of the reactor vessel, thermal-hydraulics stability, emergency systems performance and Technical Specifications, etc.

Inspection:

In order to verify the fulfillment with the license requirements and commitments acquired by the CFE, the CNSNS carries out a program of inspections that it is elaborated in a biennial base taking into account the impact in the safety that the inspected areas have according to the established in the IAEA Safety Guide 50-SG-G4 and the performance that LVNPS areas have had during the evaluated periods.

The inspections were classified in: programmed (announced and not announced), un-programmed, reactive and augmented. Additionally to the programmed inspections, there are two Resident Inspectors, one for each LVNPS unit to verify in a routinely way the fulfillment to conditions and requirements of the nuclear safety.

The main inspected areas during the LVNPS operation stage are: Operation, Radiation Protection, Maintenance, Engineering, Emergency Preparedness, Quality Assurance and Personnel Supervisor Performance.

In addition to the above, risk based inspections have been performed.

With respect to the inspections by CNSNS, all results have been documented in the corresponding inspection reports, which are in the CNSNS archives. The findings are made known to the CFE organizations involved for their prompt attention.

14.3.2.2 External Assessments Performed by Others

Prior to LVNPS-1 Commercial Operation, there have been visits or safety missions by the IAEA and during commercial operation by WANO; LVNPS is a member of the INPO of the United States of America and therefore is periodically inspected by this Institute.

Currently LVNPS is subjected to two types of external assessment:

- The first, is in compliance with the license as required by Technical Specifications. At least every 12 months an internal inspection and audit of the fire protection program and loss prevention is carried out.

  This inspection can be performed either by qualified personnel from CFE that do not belong to the LVNPS or by a specialized firm on fire protection. If the option of using CFE qualified personnel is chosen, then at least every 3 year the inspection and audit must be performed by a specialized firm on fire protection.

- The second type corresponds to external assessments that go beyond the regulatory requirements such as the OSART and ASSET missions from de IAEA, the peer review by WANO and by others. Since 1997 LVNPS is a Level 3 member of WANO.

The following is a summary of the main external assessments that were carried out from 1997 up to December of 2000.

- The World Association of Nuclear Operators – Atlanta Center conducted a Level 3 peer review of CFE's LVNPS during November 1 through 8, 1999. The review covered the following areas: Operation, Maintenance, Radiation Protection, Chemistry, Engineering, Work Control, Organization and Administration, Training (including simulator), Operational Experience and Safety Culture. The assessment identified several areas for improvement, the following were considered to be the most significant (the report is restricted according to WANO policies):

  - Safety Culture,
  - Identification and correction of key equipment problems,
  - Use of Industry operating experience, and
  - Effectiveness of management.

  All the assessment findings, depending on the related adverse condition identified, were addressed in the LVNPS Strategic Plan or in the Corrective Action Program

- As requested by the Mexican Congress and with the consent of the Department of Energy, from November 27, 2000 to January 24, 2001, the company TÜV ANLAGENTECHNIK GmbH from Germany carried out an independent audit at LVNPS. The purpose of the audit was to review the safety of the plant, its status and the operating practices in both units of LVNPS for the following main aspects:

  - Management and organization
  - Actual condition of equipment
  - Radiation protection
  - Emergency preparedness and
  - Accident risk

  The general statement of the audit with respect to the safety and regulatory compliance was: taking the applicable norms and standards (that in most of the cases are the same as in the USA 10CFR) as the minimum level of legal requirements, the team reaches the conclusion that "*LVNPS is operating in a safe manner and in compliance with the current regulatory framework, and it have not been found any indications that its operation pose an undue risk to the safety and health of the public*".

All the assessment findings, depending on the related adverse condition identified, were addressed in the LVNPS Strategic Plan or in the Corrective Action Program to be addressed.

Within the period from December 3 to 20, 2002, a second evaluation to LVNPS as level III member was carried out by WANO AC for the same areas evaluated in 1999, identifying strengths and improvement areas as a result. Action plans was assigned to each of these improvement areas and have been included in LVNPS Strategic Plan.

14.4 SAFETY ASSESSMENT, ACTIONS FOR ITS CONTINUOUS IMPROVEMENT

Since the date the original License for Operation was granted to LVNPS Unit 1 (1931 MWt), specific guidelines and specific conditions were established to guarantee that both LVNPS units would be maintained not only within a process of continuous improvement, but also to resolve issues which had not obtained consensus within the nuclear industry at the time the license had been awarded. See below for the most relevant cases:

a) Process Information Integral System (SIIP). At the time the license for operation was granted, LVNPS did not count on a Safety Parameter Display System (SPDS), part of the SIIP. Therefore, a requirement was established for such subsystem to be operative during the third cycle of operation de la LVNPS Unit 1. The SPDS-subsystem was adapted, improved and implemented by the IIE (Electric Research Institute) of Mexico in association with the original designer of the NSSS (General Electric), satisfying reliability requirements and scope established within regulatory documents.

b) Instrumentation of Vacuum Breaker Valves at the discharge of Safety/Relief Valves. Instrumentation for one of the vacuum breaker valves was requested to measure vibrations, opening times, temperatures, etc., in order to verify the fatigue analysis of components for which a modification of the design was based on. This, due to an event occurring during the execution of one of the start-up tests for LVNPS Unit 1 in which a pressurization of the primary containment was produced due to the failure of one of the vacuum breaker valves located at the safety/relief valves' discharge lines. This caused the modification of its design.

c) Station Blackout (SBO) Analysis. The Regulatory Body made a request to the owner of LVNPS to analyze the possibility of a SBO and carry out all necessary modifications to ensure that this setting was not the dominant sequence for the core damage frequency. For this effect, the requirement established in the USNRC Code of Federal Regulations, 10 CFR 50.63, was cited. LVNPS has 5 lines of connection to the network, one of these denominated dedicated, in which it is a priority and immediate obligation of the Temascal Hydroelectric Station in the

Mexican State of Puebla to provide power to Laguna Verde in the event LVNPS demands it to do so. The SBO analysis shown that LVNPS can operate up to 4 hours of SBO condition.

d) High Density Racks for Irradiated Fuel. Prior to initiating Unit 1 start-up tests, both the Regulatory Body and LVNPS proprietary, CFE, forecasted that due to the non-existence of a national regulation for handling radioactive waste (which corresponds to others instances within the Federal Government), there was a need to establish requirements to enable the safe storage of irradiated fuels in storage pools; for this effect, CFE presented for evaluation, a design of high density racks for irradiated fuel. After the design was evaluated and nuclear and mechanic design characteristics were considered, the installment of such racks was authorized in each one of LVNPS Units irradiated fuel pools. These racks will allow storing the fuel produced during LVNPS' operational life.

e) Simulator Training Requirements. Even before simulators became an essential operator's training requirement, in Mexico, both Regulatory Body and CFE agreed the best means for training operators would be a full scope simulator. The development of such tool was carried out by the IIE, totally developing it, including mathematical models, computer models and control panels.

f) Probabilistic Safety Analysis (PSA). The Regulatory Body requested, in accordance with USNRC regulations, the development of Individual Plant Examination (IPE).

As part of the new Operation License that was granted to LVNPS in order to increase thermal power 5%, CNSNS established instead of the "Specific Conditions" for the original licenses, "Requirements to Maintain the Operation License" with deadlines for compliance with the following topics:

- Assessment of the fulfillment with the ALARA objectives.
- Requirements of fidelity in the response and reliability of the simulator.
- Establishment of a strategic plan for the definitive storage of radioactive wastes of low and medium level.
- Financial mechanisms in order to have enough economical resources for the dismantling.
- Exercises and drills of the external radiological emergency plan.
- Conclusion of the alarm cleaning program.
- Maintenance of the Environmental Qualification.
- Quality list for the safety related equipment and components.
- Verification of the operability of motor operated valves and local leak criteria for check valves.

- Implementation of the Maintenance Rule.
- Program of preventive maintenance and its modifications resulting from the activities during refueling ouatges.
- To complete the implementation of the administrative procedures and to review the operating procedures.
- To include in procedures the participation of the Reactor Engineering Group.
- Maintenance of the configuration control.
- Actualization and results of the Improved Water Chemistry Program.
- Analysis of the effectiveness of the Loose Part Monitoring system.
- Conclude the Individual Plant Examination by a PSA Level 2.
- To conform a Root Cause Analysis Team.
- To reinforce the Safety Culture elements giving special emphasis to the conservative decision-making and the strict fulfillment of procedures.
- Reduction of the adverse quality conditions.
- Results of individual and collective radiological doses, personnel contamination, generation of solid dry waste, unplanned exposition to radiation, during refueling outages.

14.5 NEW FUEL DESIGNS FOR LVNPS

14.5.1 Historical Conformation of LVNPS Core

The core of each unit at LVNPS contains 444 fuel bundles and 109 control rods. The fuel supplier initially was supplied by General Electric Co. and currently is supplied by Global GNF (Joint venture GE, Toshiba and Hitachi).

The first cycle for both units of LVNPS was conformed by GE6 (8X8) fuel type, which contains 62 fuel rods and 2 water rods. Cycle 1 of Unit 1 started on July 1990 and finished on August 1991, while for Unit 2 started on April 1995 and finished on June 1996.

At Unit 1, from cycle 2 to cycle 5, it was introduced the GE9B (9X9) fuel type, which contains 60 fuel rods and one large centrally located water rod, so the core was mixed with these two types of fuel. This period covers from November 1991 until September 1996. For Unit 2 the same case occurred from cycle 2 to cycle 4, September 1996 until March 2000.

The core for cycles 6 and 7 for Unit 1 was loaded only with the GE9B fuel type, since December 1996 until August 1999.

Since cycle 8 of Unit 1 (September 1999 through May 2001) and to Cycle 10 of Unit 1 (September 1999 to April 2004), the GE12 (10X10) fuel type was introduced, so both units had mixed cores again. The same situation occurred in Unit 2 from the cycle 5 to Cycle 7 (June 2000 to October 2004) having again a mixed core. However, from Cycle 11 in Unit 1 and Cycle 8 in Unit 2 the core of Unit 1 has been formed only by GE12 type fuel assemblies. This fuel type contains 92 fuel rods (fourteen being partial length rods) and two large central water rods.

14.5.2 Licensing of New Core Configurations

With the objective of licensing the new core configurations for each cycle of both units of LVNPS, CFE submits to CNSNS for assessment a set of specific analysis reported in the document “Supplemental Reload Licensing Report” (SRLR), these analysis include:

- Core Effective Multiplication Factor.
- Standby Liquid Control System Shutdown Margin.
- Anticipated Operational Occurrences Analysis (AOO).
- Local rod withdrawal error.
- Thermal limits (MCPR: safety and operational limits).
- Overpressurization Analysis.
- Loading error

About control rod drop, stability and LOCA analyses, they appear in the SRLR and the references and the documents where they were provided, and evaluated also by CNSNS.

14.5.3 Problems Originated in LVNPS Core

On January 1995, power oscillations were detected at Unit 1. With regard to this event, the CNSNS sent an Augmented Inspection Team to the site. As a result of this effort, it was required to the utility to follow the applicable recommendations of the USNRC Bulletin No. 88-07 “Power oscillations in BWR’s” and its supplement 1, along with the USNRC Generic Letter 94-02 “Long term solutions and upgrade of interim operation recommendations for thermal hydraulic instabilities in BWR’s”. So, CFE studied the possibility to implement the so called Option III of the BWR Owners Group, which implies the installation of a Monitoring System, to incorporate the possibility to alarm and shutdown automatically the plant when the power oscillations reaches +/- 10 %.

14.6 PROBABILISTIC SAFETY ANALYSIS (PSA)

With event and fault trees that represent the current characteristics of the design and operation of LVNPS, the incorporation of plant specific data for component failure, and initiating event frequencies, the contribution of the various accident sequences can be obtained.

As examples of the safety improvements performed as result of the PSA Level 1 study, it can be mentioned:

1. Installation of a hard pipe cross tie between the fire suppression system (with a diesel driven pump) and the Residual Heat Removal System (RHR), allowing water injection into the reactor vessel and containment spray under blackout conditions.

2. Preventive maintenance of depressurization system backup pneumatic supply components, which are not verified when normal supply is operating.

3. Modification of the design related to the actuation logic of the low pressure ECCS systems, which contributed to an 84% reduction in interface LOCA contribution.

In addition to the above, in the PSA activities, there has been a large participation of personnel from Operation, Engineering, Maintenance and Training. This has resulted in the dissemination of PSA achievements in key plant activities and procedures.

ARTICLE 15. RADIATION PROTECTION

15.1 INTRODUCTION

The spirit of the Regulatory Law of the Constitutional Article 27 on Nuclear Matters and the General Regulations for Radiological Safety and the norms arisen from these documents is to maintain the protection of its employees, civil population and that of their property and environment as its center of attention, establishing that nuclear and radiation safety is a priority for all activities involving the use of nuclear energy.

15.2 DOSE LIMITATION SYSTEM

The Article 7 of the General Regulation on Radiation Safety indicates that the dose received as a consequence of an exposition of ionizing radiation sources and from practices that involve irradiation with ionizing radiation or incorporation of radioactive material, will be subject to a dose limiting system whose fundamental ideas are the following:

- Practices that may produce doses to workers shall not be approved unless a positive net benefit is obtained.
- The design, planning, use and subsequent application of the sources and practices should be carried out in a manner that ensures that the expositions are maintained as low as possible considering social and economic factors;
- The establishment of limits for dose equivalents.

15.3 LVNPS RADIATION PROTECTION

The means were established from the design stage by shielding, physical separation, air conditioning and ventilation systems, to delimit the radiation zones of equipment, component and systems which would be potential radiation sources during the operation stage.

The buildings considered in where radiation protection criteria were taken into account for the design include: reactor, turbine, radioactive wastes, fluid-purification, Unit-1 & 2 control rooms, heat shops and open areas of a potentially low contamination.

In order to limit operation personnel doses, LVNPS buildings were divided into zones. These zones include five categories that consider radiation levels according to the following extreme cases:

- Zone 1 - unlimited permanence is allowed with an exposure rate of less than 25 E-7 Sv/hr, when integrated per year does not exceed the 0.005 Sv/year dose limit.

- Zone 5 - the highest radiation level zone. Access is restricted and controlled.

There is additional control for integrated doses of the occupationally exposed workers. This consists of a national data base with records of all workers, and is administered by the Regulator. Under this procedure, the dose is known for each worker registered in the radiation protection system at the LVNPS.

This mechanism has allowed identifying improper handling of dosimeters, workers whose accumulated doses are approaching their administrative limits, workers that change companies, etc.

Improved procedures, the consolidation of the planning system, the gradual adoption of a more deep safety culture and a substantial reduction in the radioactive source term, have resulted in a clear descending tendency in collective dose, independent of other notable improvements in radiation protection.

15.3.1 Radiation Protection Program

The main purpose of the Radiation Protection Program is to establish procedures and practices that in conjunction with the design generate the radiation protection characteristics required to maintain the radiation exposure dose received by persons working within the site as low as reasonably achievable (ALARA).

In accordance with the ALARA policy, not only on-site but also off-site, important efforts are made to limit liquid and gaseous effluent releases to the environment to minimize radiation exposures affecting the public. For this effect, there is an off-site dose calculation manual (ODCM) consisting of:

a) Methodology and parameters to be used to calculate plant concentrations and doses due to liquid and gaseous effluent releases from LVNPS during normal operation, transients and anticipated operational events.

b) Methodology and parameters to determine LVNPS liquid and gaseous radioactive effluent monitor’s set points.

c) Methodology and parameters to determine dose levels on the boundaries of the non-restricted area by direct radiation from normal operation and transients.

The radiation protection manual is used to govern the radiation protection actions and consists of the following:

i) Radiation protection procedures

ii) Analysis procedures

15.3.2 Environmental Radiological Impact

The impact to the environment depends on the radioactive material released.

Effluent and radiological process monitoring and sampling systems are provided to determine the contents of radioactive material in diverse process flows gas and liquid effluent streams.

There are two types of surveillance systems. The first one consists of instrumentation systems required for safety and, the second consists of instrumentation systems required for the operation of LVNPS.

The main purpose of radiation monitoring systems required for safety, in the event that predetermined radiation levels in effluent streams are exceeded, is to initiate appropriate protective actions to limit the potential release of radioactive material from the reactor vessel, reactor building and protect the environment of the main control room in both units of the LVNPS.

The radiation monitoring systems required to operate LVNPS provide operation personnel the measurement of the contents of radioactive material in all important effluents streams and process flows. This enables demonstration of compliance with the Technical Specifications by providing monitoring of gross radiation levels and the collection of halogens and particles in filters. Additionally, in the event that predetermined release rates are exceeded, these provide initiation of the isolation of the main condenser discharge valve towards the mechanical vacuum pumps and steam jet air ejectors. Likewise, these systems provide the obtaining of radiation samples within certain locations to determine specific radionuclide contents.

15.3.3 Regulatory Body Radiation Protection Verification

Regarding to surveillance of public exposure from the normal operation of the plant, CNSNS has several independent means by which compliance with the regulation on environmental impact are verified:

a) Analysis of the radioactive emission section of the daily operation report in which actual time data from process instrumentation for radiological effluent is contained.

b) Assessment of biannual effluent accounting reports remitted by LVNPS, containing data resulting from isotopic sampling and analysis of liquid and gaseous emissions during the period informed. Actually, the reports for each second semester are annual compendiums also including dose calculations and meteorological information of interest. A part of CNSNS' assessment consists of

an independent reproduction of such dose calculations in order to verify their consistency. These assessments are carried out in compliance with Regulatory Guide 1.109 of the USNRC.

c) Evaluation of the Environmental Radioactive Surveillance Annual Program Report containing information on isotopic sampling and analysis from different environmental strata and performed at LVNPS' off-site laboratory.

d) Independent isotopic analysis of samples collected periodically by CNSNS from locations around the plant site to be processed and analyzed at CNSNS laboratory. This program has served as an additional source for verification, through which the regulator has corroborated the consistency of the information presented by the licensee.

Both CFE and CNSNS laboratories take part in International Programs of Inter-comparison to ensure the reliability of their measurements.

CNSNS, as the National Regulatory Body, carries out periodic audits, surveillances, inspections and assessments of radiation protection activities at LVNPS-1 & 2.

ARTICLE 16. EMERGENCY PREPAREDNESS

16.1 LVNPS EMERGENCY PLANS

16.1.1 Regulatory Aspects

Article 28 of the Nuclear Law stipulates: *"Authorizations for construction and operation of a nuclear installation shall be issued only when it can be demonstrated, by presenting the pertinent information, how safety objectives are to be attained and which procedures and methods will be used during the siting, design, construction, operation, modification, final closing down and dismantling stages. In addition, the corresponding radiation emergency plan shall be presented. Such information should follows the terms and forms stipulated in the regulatory provisions of this Law"*.

In the same way, Article 50, Fraction VII, defines Regulatory Body attributions and responsibilities: *"Prior to the start-up of operations, review, assess and authorize the plans that should be in place for dealing with anomalous or emergency conditions in nuclear and radioactive installations".*

The General Regulations on Radiation Safety establish in a particular manner, in Article 124, that: *"Prior to initiating operations, all radioactive (and nuclear) installations must have a congruent Emergency Plan having guidelines contained in the National System for Civil Protection and based on a survey of the consequences of accidents that could occur at the installation".*

Condition 13 of the Operating Licenses of Units 1 and 2 emphasizes the necessity to maintain updated the Emergency Radiation Plans.

16.1.2 Emergency Response Organization

The Emergency Preparedness for the LVNPS is formed by two different and complementary plans known as The Internal Emergency Plan and External Radiation Emergency Plan.

Internal Emergency Plan

The Internal Emergency Plan forms part of the LVNPS Integrated Emergency Preparedness, developed by the Federal Commission for Electricity (CFE).

The Internal Emergency Plan describes the Organization, Resources and Directives that will be applied under emergency situations at Laguna Verde NPP. This Organization fulfills the requirement of the NUREG- 0654.

There is a central group named Group of Technical Support composed of the Coordinator of Emergencies at the Site and four directors (Radiological Control, Evaluation of Accidents, Repairs of Emergency and Operations) supported by two Notifiers of Emergency and an Advisory Group, with task groups for each of the response areas such as: Fire Protection Brigade, Operational Support, Evaluation of Accidents, Radiochemistry, Dose Projection, Surveillance and Decontamination, Environmental Surveillance, Damage Control, Logistic Support and Physical Security.

A Center of Technical Support is available and located in an area adjacent to the main Control Room, where there are work stations with signals from the Integral Information Process System, which provides the key variables of the operating plant status, and the radiation and environmental status.

External Radiation Emergency Plan

The Radiation Emergency Plan Response Organization is composed of the Federal and State entities listed below. These entities form the External Radiation Emergency Plan Committee (COPERE):

- Secretaría de Gobernación (SEGOB, Department of the Interior)
- Comisión Federal de Electricidad (CFE, Federal Commission of Electricity)
- Secretaría de Comunicaciones y Transportes (SCT, Department of Communications and Transportation)
- Policía Federal Preventiva (PFP, Preventive Federal Police)
- Secretaría de la Defensa Nacional (SEDENA, Department of Defense)
- Secretaría de Marina y Armada de México (SM-AM, Department of Navy)
- Gobierno del Estado de Veracruz (GEV, Government of Veracruz State)
- Secretaría de Salud del Estado de Veracruz (SESEVER, Department of Health for the State of Veracruz)
- Instituto Nacional de Investigaciones Nucleares (ININ, Nuclear Research National Institute)
- Comisión Nacional del Agua (CNA, National Commission of Water)
- Procuraduría Federal de Protección al Ambiente (PROFEPA, Environmental Protection Agency)
- Distribuidora e Impulsora Comercial CONASUPO (DICONSA, CONASUPO Distributor and Commercial Promoter)

Representatives of these Dependencies, with responsibilities in the Plan, participate in the updating of the Plan and Procedures regarding personnel training, public information, verification of human and material resources as well as the planning and

performing drills and exercises. Additionally, these Dependencies propose the activities for maintaining the ability in the performance of the Plan and every two years review the procedures.

16.1.3 Emergency Assessment Actions

The Emergency Plan describes a means for determining the magnitude of a radioactive material release as well as its continuous assessment. It includes emergency levels used as criteria in determining the need for notification and participation of local and state authorities. Based on emergency action levels, it is determined when and what kind of personnel and public protective measures are to be used on and off site boundaries. In order to define emergency action levels, plant & instrumentation conditions are used in addition to radiological surveillance on and off-site. There are four classes of emergencies defined as follows:

Unusual Event: referring to events in process or which have occurred, not common, indicating a potential degradation in the plant's safety level. In an event of radioactive releases, the value of these exceeds 2 times the Technical Specifications limits for a period greater than 60 minutes, not requiring a response or off-site monitoring, unless degradation of safety systems persists.

Alert: those events in process or which have occurred involving a real or potential substantial degradation in LVNPS' safety level. In the event of radioactive releases, it is expected for such releases to exceed 200 times the Technical Specifications limit for a period greater than 15 minutes.

On-Site Emergency; referring to events in process or which have occurred involving real or probable major failures of operations necessary for public protection. In the event of radioactive releases, it is expected for these to exceed the integrated whole body dose of 1 mSv (100 mR) or infant thyroid's dose of 5 mSv (500 mR) during release duration up to site boundary.

General Emergency: those events in process or which have occurred involving a substantial degradation of the core, real or imminent, or melting of the core having a potential to lose contention integrity. Discharges are expected to exceed the integral whole body dose of 10 mSv (1000 mR) or infant thyroid's of 50 mSv (5000 mR) beyond site boundary.

Two zones are defined for those areas or zones surrounding LVNPS that require of population protective measures: Plume Zone (a radio of 15 km from LVNPS) and Ingestion Zone (a radio of 70 km from LVNPS).

To support emergency preparedness activities the following is available:

- Integral Process Information System, that includes the Safety Parameter Display System (SPDS).

- RASCAL Code, Radiological Assessment System for Consequences Analysis developed by Oak Ridge National Laboratory.

- Core Damage Estimation Methods based on the MELCOR Code, “Melting Core” developed by Sandia National Laboratory.

In addition to these computational tools, the following analytical tools are available, for confirmatory purposes:

- Isotopic Analysis using Gamma Spectrometers,
- Ionic Chromatography
- Atomic Adsorption.

All systems and equipment are available at Laguna Verde NPP and there are capable and trained personnel to operate them.

16.1.4 Installations and Emergency Equipment

The Emergency Plan includes as part of the material resources, human resources and agreements (with state and local authorities) necessary, the following:

- Monitoring equipment for response personnel
- Equipment to determine the magnitude and continuous assessment of a radioactive material release to environment.
- Equipment to notify the emergency, on-site and off-site.
- Equipment to evacuate personnel on-site and public from affected area sectors.
- Site installations and supplies to decontaminate individuals on-site.
- Off-site installations and supplies to decontaminate response personnel and the public.
- Off-site medical installations and supplies to provide first aid treatment during an emergency.
- On-site medical installations and supplies to provide first aid treatment and specialized medical attention to response personnel and the public.
- Medical services and qualified medical arrangements to handle on-site radiological emergencies.

- Medical services and qualified medical arrangements to attend patients as a result of radiological emergencies.
- Arrangements for transporting injured and contaminated people on-site and public affected.
- Technical Support installations, installations for operation near the site and from where a good management and effective control can be achieved during an emergency.
- At least one communication system on-site and another off-site, each counting on their own back-up power system.
- Arrangements to provide sheltering to public evacuated.
- Arrangements for surveillance of the emergency zone as well as for the rescue of people possibly affected.
- Arrangements to control water and foods required within the zone.

16.1.5 Emergency Plan Activation Exercises/Drills

Several emergency plan drills, either internal or external, have been carried out in order to verify the suitability and validity of the preparation for a radiological emergency in LVNPS.

16.2 MEASURES FOR INFORMING THE PUBLIC IN RELATION TO EMERGENCY PREPAREDNESS

A section in the Emergency Plan includes a permanent program of divulgation in order to familiarize the public with the plan as well as to orient them, for their own safety, on the conduct to be observed during the execution of it. LVNPS owner, the State Government of Veracruz and Department of the Interior are in charge of the application of this program. Part of the strategy of divulgation of preparations for an emergency consists of the distribution of written information and public informative programs by LVNPS personnel. To this respect, permanent contact is maintained with the population leaders of the zone whom assist in the program of public divulgation on LVNPS and the Emergency Plan. Moreover, a calendar is prepared each year, in co-ordination with all dependencies participating in the Emergency Plan, and distributed to the inhabitants of the zone. This calendar describes actions to be taken in case of an emergency at LVNPS.

During 1998–2000, the following activities have been developed:

- Community workshops on information to the inhabitants that are in the radius covered from the exterior of the fence property of the LVNPS to 16 kilometers. Particularly, this included a description of the Laguna Verde NPS and the activities

of the External Radiological Emergency Plan (PERE). These events were carried out during the second semester of the year 2000, with the important participation of the children in school age and the leaders of the area. These community workshops were held in each of the municipal heads that are covered in the PERE. This effort was developed with the participation of the CFE and the National Center of Prevention of Disasters (CENAPRED).

- Taking advantage of the First National Week of Civil Protection, carried out in September 18-22 of the 2000, a great diffusion in the local and national press was given to one of the three partial exercises carried out during that year, which covered the displacement of the forces known as "Immediate Reaction", conformed by the National Defense, Army and the Preventive Federal Police. This was the first exercise in which the journalists were invited as observers of the activities of protection. This was considered by the communication media as a good opening symptom.

The fundamental premise of the community workshops was to ensure that the information for the application of protective actions were clear and understandable for the inhabitants of the plume zone.

16.3 INTERACTION WITH NEIGHBORING STATES

Mexico is part of the Convention on Prompt Notification of Nuclear Accidents and also of the Convention on Assistance in the Event of a Nuclear Accident or Radiological Emergency since 1988 and in the event of a radiological emergency at a Mexican nuclear facility in which the probability of affecting neighboring state territories exists, there is a procedure under the responsibility of CNSNS whose objective is to notify under the terms of the aforementioned Convention on Prompt Notification, the occurrence of such kind of events. Regardless of the above, Mexico holds bilateral agreements for exchanging technical information (including the occurrence of important events) with its nearest neighbors.

Mexico is also part of the World-Wide System of Early Communication of the IAEA, through which immediate information is provided to the IAEA in the event of a radiological emergency at LVNPS. In general, this same information is available for neighboring countries. Likewise, Mexico is signatory of the Convention on Civil Liability for Nuclear Damages. It is important to mention that LVNPS is located more than 500 km away from the nearest country.

Mexico has a National System of Civil Protection. In the event of a Radiological Emergency at a US nuclear station near to the Mexican border which has a probability of affecting the national territory, the DN3 Plan would be activated. The Department of Defense, under the direction of the Secretary of the Interior, is responsible for the application of the Plan, aided by the Department of Health and CONASUPO. The DN-3

Plan includes the infrastructure necessary to establish adequate communication, capacity of evacuation, and to establish control centers that allow taking appropriate actions during the emergency. However, it is important to mention that nuclear stations in the USA are located more than 100 km away from the border with Mexico. Other bordering countries, like Guatemala have no nuclear power stations and therefore are not expected to affect the national territory.

16.4 REGULATORY BODY ACTIVITIES

CNSNS reviews and approves the LVNPS Emergency Plans (internal and external to the plant site), as well as the procedures to control and implement all the activities related to those plans. On the other hand, all the activities and procedures for the external response of the emergency are reviewed and approved by the organisms (federal and state dependencies) that have responsibilities within the external emergency plan.

During the occurrence of an accident, the main responsibilities of the Regulatory Body are to advise the Federal Government in the decision-making process. For this, an Emergency Committee is installed immediately after the notification of any radiological incident and in particular upon the activation of the LVNPS Emergency Plan. See Article 8 in this National Report. Under this situation, the main task of the National Commission of Nuclear Safety and Safeguards (CNSNS) is the surveillance of the actions taken by the task forces and to serve as a consultant for the Federal Government in the decision making. The CNSNS to perform its responsibilities has a: Contingency Center, phones, computers and links with all the centers in which the activities are taken place during the emergency.

As regards to LVNPS' Emergency Plan, an important duty of CNSNS is to carry out inspections and audits on the level of fulfillment of the preparations within each one of the dependencies forming part of the Plan. CNSNS designs integral drills both for the Internal and External Plans and it assess the performance of each one of the dependencies participating. In a similar manner, CNSNS reviews and evaluates the Emergency Plan document and related procedures.

ARTICLE 17. SITING

17.1 REGULATORY ASPECTS

Prior to granting the Construction Permit, the owner of LVNPS provided information for authorization of the location of the site where the construction was to initiate; even though the Nuclear Law is posterior to the initiation of the construction work, the regulatory standards to approve this stage of the installation were 10 CFR 100 and 10 CFR 50 Appendix A. The following Regulatory Guides (RG) were added as soon as edited: R.G. 1.29 defining seismic design classification; R.G. 1.59, related to design basis for flooding; R.G. 1.60 defining seismic design response spectra; R.G. 1.61 establishing seismic design damping values; R.G. 1.70 on safety report standard forms and contents; R.G. 1.76 on design basis tornado; R.G. 1.91 considering human activities nearby nuclear installations, defining explosion characteristics occurring within the vicinity of the plant; R.G. 1.102 on protection against flooding; R.G. 1.111 on radioactive effluent dispersion; R.G. 1.132 on foundation investigations and R.G. 4.2 on environmental impact reports.

Recently and due the update of the seismic monitoring instrumentation, the LVNPS the OBE Exceedance Criteria has been incorporated, following the USNRC Regulatory Guide 1.166 entitled "Pre-earthquake Planning and Immediate Nuclear Power Plant Operator Post Earthquake Actions". This guide considers the effects of high frequency accelerations. Also, the damage scale for nuclear power plant facilities contained in the document EPRI NP-6695 has been incorporated, which is similar to the Scale of Mercalli.

17.2 LAGUNA VERDE NUCLEAR POWER STATION SITE

After performing an analysis, in combination with experts from the IAEA (in 1968), on the different sites proposed, it was decided that the site which gathered seismic, accessibility, cool water supply, demographic and location characteristics was the place located on geographic co-ordinates UTM Latitude 19° 43’ 30” North and Longitude 96° 23’ 15” West, in the State of Veracruz.

Once the preliminary selection was made, detailed studies were initiated, considering Geography, Demography, Meteorology, Hydrology, Geology, Geotectonics, and Seismicity as well as the impact these would have on the installations, occurrence of diverse weathering and activities generated by man.

This information was provided as part of the Preliminary Analysis Safety Report (PSAR), later updated in the Final Safety Analysis Report (FSAR) and submitted to CNSNS as a support of the request of license to operate LVNPS-1 & 2 (see Article 7 of this Annex II).

In addition, CNSNS requested the delivery of an Environmental Report in addition to the information presented in the Final Safety Analysis Report.

17.2.1 Design Basis as Regards to LVNPS-1 & 2 Siting

Main site characteristics (Geography and Demography, Impact of Industrial Installations and Geology, Seismology an Geotectonic Engineering) used in defining design basis related to LVNPS-1 & 2 Siting are briefly identified below.

- **Geography and Demography**

The geography analysis performed took into account population growth perspectives, zones of its influence and changes in the land uses up to the year 2020. Areas of property over which CFE has authority were defined exactly as required by the applicable standards, for instance the Restricted Area, Controlled Area and Exclusion Area:

There are no high-density population areas within a vicinity of 10 km from LVNPS. Similarly, there is only one settlement of 5 inhabitants within a radio of 2 km from the plant. The low population area, as defined in 10 CFR 100, consists of an area of a radio of 15 km from the site. Population projected within this zone for the year 2020 is approximately 34,530 inhabitants, being considered a low density population. Population centres currently of over more than 20,000 inhabitants covering a radio of 70 km from LVNPS are:

CITY	POPULATION	DISTANCE FROM SITE (KM)	DIRECTION
Coatepec	127,531	65.6	WSW
Jalapa	635,364	57.5	WSW
Veracruz and surrounding suburbs	~ 1,000,000	70.0	SSE

- **Impact of Industrial Transportation and Military Facilities Nearby the Site**

There are no military, chemical or fabrication industry, airport or chemical storage facilities within a radio of 8 km from the site which could potentially affect the operation of LVNPS-1 & 2.

The most important route of transportation within a radio of 10 km is Federal Road No. 180 running North to South and 2 km West from the site. This road serves as the means of access to LVNPS having a vehicle flow of less than 3000 vehicles per day.

The nearest commercial railway is located at 40 km from the site and there is a private industrial railway extension 15 km from the site, which is rarely used.

The nearest airport is located 70 km South from Laguna Verde, in Veracruz. The main runway is 2500 m long and 45 m wide.

A maritime route between Veracruz and Tampico passes in front of the site at an approximate distance of 83 km. In addition, small fishing boats operate over 5 km away from Laguna Verde's coast. The design of the intake structure of LVNPS 1 & 2 considers breakwaters to protect it from any impact produced by this kind of boats.

A 7.5 cm diameter oil pipe and another 121 cm diameter pipe for natural gas, property of the Mexican Petroleum Company (PEMEX) passes by LVNPS' installations (Reactor Building) at approximately 1200 m.

As part of the assessment of the impact of facilities within the vicinity on LVNPS-1 & 2, the following events were analyzed:

Explosions

a) Due to the distance between the road and maritime routes, and LVNPS, no event postulated on such routes represents a risk for structures important to safety, since the effects caused are involved in considerations of the seismic design basis, tornado design basis and hurricane design basis.

b) Hypothesis of gas pipe line incidents were analyzed in regards to:

   Explosion and thermal load through ignition of leaked gas.

   Results of the analysis show both that the pressure peak caused as well as the thermal load produced by explosion are inferior to the hurricane design basis and thermal structural design.

Toxic Chemicals

No important amounts of toxic chemicals are used or stored within the vicinity (8 km) of LVNPS.

Fires

There are not any external installations within the vicinity of LVNPS, which could lead to producing fire conditions.

Therefore, considering the above-cited information, it is observed that there aren't any installations within the vicinity that may be considered as a basis for the design of Laguna Verde.

The design of structures, systems and components for LVNPS-1 & 2 was based upon normal and extreme meteorological and hydrological conditions, which could hypothetically appear at site. This includes the consideration of maximum sustained winds, tornado winds, effects from a maximum probable hurricane, maximum probable flooding and seige, surge and tsunami wave effects. Furthermore, and in a conservative manner, structures important to safety have been analyzed against stresses resulting from an elevated 3 m high flood above the installation's ground level.

- **Geology, Seismology and Geotectonic Engineering**

LVNPS's siting is located at the intersection of parallel 20 and the Trans-Mexican Volcanic Belt (TMVB). This belt is an east -west – trending belt of volcanic vents and volcanic units that extends from the Pacific coast north of Puerto Vallarta to the area of the Laguna Verde NPS site on the Gulf of Mexico. The TMVB is the indirect result of the subduction of the oceanic Cocos Plate sliding beneath continental Mexico from the Central America Trench along the Pacific Coast of southern Mexico. The subducted slab of the Cocos Plate melts and depths of about 100 km, producing magma that rises to form the volcanoes and related magma bodies of the TMVB.

Heat flow measurements suggest that the TMVB typically have a thin brittle crust with the remaining crust below being typically plastic rather than brittle. This thin brittle crust can not store great strain energy, which explains why the TMVB is located in an area of relatively low seismicity, and that the damaging earthquakes that have occurred within the TMVB have not approached in magnitude to the great earthquakes typical of the Benioff Zone.

LVNPS's siting is located in the Trans-Mexican Volcanic Belt, close to the eastern border of the province. The facility is founded on a mass of Pliocene-Pleistocene basaltic rocks running along the Gulf of Mexico over an approximate 1.4 km extension of a variable 30 to 50 meter thickness. Stratigraphic studies show the existence of a subjacent layer of alluvium consolidated deposits of a 40 to 65 meter thickness deposited over andesitic material, extending itself 150 meters in depth. The basaltic layer presents a columnar fracture of thermal nature of lengths going from 6 to 8 meters.

In order to satisfy the regulatory requirements, CFE performed the following studies: Physiography, Geological History, Differential Settlements and Upheavals, Stratigraphy, Faulting, Chemical Weathering, Cavernous and Carstic Terrain, Subsoil Faults Under Dynamic Load, Pre-consolidation Evidence through Volcanic Erosional Processes, Liquefaction, Slope Stability, Permeability and Freatic Levels, Seismic Stability of

Alluvium Materials subjacent to Superficial Basalt and Flow of Ashes and Lava from a Potential Volcano Eruption.

Because of the proximity of the site to different volcanoes of the eastern TMVB, the near field effects (ashfall and lava) at El Abra and the far field effects eruption at Pico de Orizaba, were analyzed. Due to the geologic characteristics, morphology of the cone and crater, other kinds of possible effects were not considered possible. There is not any evidence to associate the cinder cones at El Abra with historic macroseismicity.

In this specialty, the atmospheric shock waves induced by explosions were also considered.

The following regional environmental studies were performed covering a radio of 320 km: Volcanic activity, Superficial faulting, Tsunami and Tectonic of sea bed, Attenuation of vibratory movements of Trans-mexican volcanic belt terrain, Tectonic provinces and maximum historically-related earthquakes, Acellerograms, Determination of Design Basis and Operation Basis Earthquakes, Geological-Seismic conditions on continental platform and Sea bed boundary, Correlation of regional seismicity with that of the site, Structural relations between "Graben", "Palma Sola", "Cofre de Perote" and "El Farallon", Related tectonics; Analysis of two faults parallel to volcanic cones of "El Abra", Related tectonics; Distribution of mine fracture systems and the zone of "La Viga-Tuxtla" as well as distinction fracture system of "El Abra, Tectonics related.

The Seismic Design Basis for Laguna Verde was defined using the Peak Ground Accelerations that were computed for the maximum earthquakes identified for each seismotectonic province and similarly for each of the potential seismogenic structures that were identified within the Trans Mexican Volcanic Belt (TMVB).

Peak ground accelerations were computed using six different formulas that appear in common literature (Campbell, Joyner and Boore, Idriss, Bufaliza, Esteva and Villaverde and Esteva conservative).

The response spectra for the design Safe Shutdown Earthquake (design SSE) was obtained using the criteria of the US Regulatory Guide 1.60 and, the value of 0.26 g for the safe shutdown peak acceleration was determined. The return period for the design SSE is 2000 years. From this value it was obtained as 0.14 g for the Operating Basis Earthquake (OBE) that corresponds to nearly a half of the SSE.

These seismic design parameters for Laguna Verde NPP were originally developed from a conservative assessment of the potential for earthquakes in eastern continental Mexico and the adjacent area of the Gulf of Mexico. These are based on 1979 site specific studies regarding site ground motion characteristics. Subsequently the CFE has undertaken a series of geological, geophysical, seismological investigations to better evaluate the potential for earthquake induced ground motion at the site. The results of

these studies confirm the conservatism of the original design parameters and do not suggest the necessity for changes in the original design criteria.

These last studies were issued in 1987, and were performed taking into account a large amount of data coming from different sources: Mexican Petroleum Company (PEMEX), The US Geological Survey, The Texas University, The Texas A & M University. These studies not only confirmed the original design ground acceleration and potential for an earthquake, but they strongly indicate that a lower ground acceleration motion could be proposed to Regulatory Body. The original and current ground motion is 0.26 g and the last studies suggest an acceleration of 0.18 g.

As part of the Periodic Safety Review process, performed back in 1999, the above was confirmed and currently CFE is carrying out a Probabilistic Risk Assessment of External Events which considers seismic events.

Particularly, in relation to the volcanic risk and as an example of the detail and deepness of the studies performed, both active and non-active volcanoes within a radio of 150 kms from the site, including those corresponding to the sea bed, were analyzed. In order to provide conservative results of the effect of a volcano eruption, the following was considered as an analysis basis event:

1. The birth of a new volcano 13.5 km away from the site in direction of the ash volcanoes "El Abra", producing quantities of ash and lava equivalent to data on the Paricutin Volcano, and

2. The eruption of the "Peak of Orizaba", considering the amount of ash expulsed equivalent to that of Mount St. Helen in U.S.A. on May 18, 1980.

Results determined that the effect of a nearby ("El Abra") or so far ("Peak of Orizaba") volcano eruption would not affect the safe condition of LVNPS-1 & 2.

17.2.2 Effect of the Seismic Events on LVNPS

A series of seismic events have been perceived in the LVNPS site for which the operation personnel have declared "Unusual Event". However, when their effect it has been evaluated it has been determined that none have had any adverse effect or any damage to the systems, structures and components of LVNPS 1&2.

Two seismic events have been of particular interest. One perceived in June of 1997 and the other one in August of the year 2000, where the OBE spectra was surpassed in the zone of high frequencies. However, it has been determined that neither they have had an adverse effect in the LVNPS. For such a reason, it has been incorporated in the LVNPS the OBE Exceedance Criteria, following the USNRC Regulatory Guide 1.166 named "Pre-earthquake Planning and Immediate Nuclear Power Plants Operator Postearthquake Actions", which considers the effects of the accelerations of high

frequencies. Also, it has been this guide has incorporated the "Damage Scale for Nuclear Power Plant Facilities" contained in the document EPRI NP-6695, which is similar to the Scale of Mercalli.

Associated to the above-mentioned, the CFE has updated to date of the System of Seismic Monitoring of the LVNPS.

In this respect, the CNSNS has evaluated the mentioned events and it has determined that the results and analysis obtained by the CFE have been satisfactory.

17.3 CONSEQUENCES TO THE LVNPS SURROUNDINGS DUE TO OPERATION

In compliance with the General Law of Ecological Equilibrium and Environmental Protection and requirements for awarding LVNPS' License for Operation, CFE submitted to CNSNS, an Environmental Report following the guidelines in Regulatory Guide 4.2 of the USNRC. The main purpose of this report is to show that the impact of LVNPS' operation will not cause important disturbances within the immediate siting environment.

An evaluation was performed on LVNPS' effect of operation to environment, both under normal operating conditions, in function of liquid and gaseous radioactive effluents, chemicals, biocides and sanitary and under abnormal accident conditions resulting from the postulation of very low probability occurrences, being the objective to verify the installation's capability for their control and mitigation.

For effects of normal operation, an environmental monitoring program has been implemented. It is ruled by LVNPS-1 & 2 Technical Specifications. This program initiates during the pre-operational stage to determine the baseline of comparison to detect, in an immediate and early manner, any effect of environmental deterioration.

Previous to the awarding of LVNPS-1 & 2 operation licenses, CNSNS evaluated the environmental report, determining that the real impact of LVNPS operation resulted in effects within the environment that entirely satisfy the installation's design objectives. In relation to the monitoring program, regardless of how adequate and reliable the program developed and implemented for CFE is and of the International Inter-Comparison Analysis to which its results are subject, CNSNS, as of 1979, initiated an environmental sampling survey program to determine the baseline and monitoring during operation in a totally independent manner from CFE. To this day, the results obtained by CFE have proved to fit the results obtained by CNSNS. No significant statistical differences were identified in relation to environmental radioactivity pre-operational values.

ARTICLE 18. DESIGN AND CONSTRUCTION

18.1 REGULATORY ASPECTS

The Regulatory Law of the Constitutional Article 27 on Nuclear Matters in Articles 15, 19, 20, 21, 25, 26, 28, 32, 34 and 50, in general terms, establishes the requirements to be satisfied by nuclear installations from the design phase, during construction and the operation stage.

Since the first edition of the Nuclear Law that dates from 1979, when the design of LVNPS was found to be quite advanced and the construction already had initiated four years back, the criteria that ruled the general conception of the original design was based on the philosophy that “any nuclear installation built in Mexico shall satisfy the applicable requirements as it should be licensed in the country of origin of the nuclear steam supply system”. Due to this, the first agreement of the referenced standard for licensing was based on Title 10 “Energy” or 10CFR of the Code of Federal Regulations of the United States of America.

In particular, 10 CFR 50 and Appendix A, establish fundamental criteria for design, fabrication, construction, testing and performance requirements for structures, systems and components important to safety. This ensures in a reasonable manner that the installation may be operated without undue risk to health and safety of operational personnel and that of the public and their property.

Based on this regulatory framework, basic design criteria satisfied the following six groups: General Requirements, Protection by Means of Multiple Barriers against Release Fission Products, Protection Systems and Reactivity Control, Fluid Systems, Reactor Containment, and Fuel and Radioactivity Control.

On the other hand, the construction process was performed in compliance with industrial standards, codes, industrial and quality standards corresponding to the quality required by the nuclear industry in the USA. For example, concrete structures were raised under the standards of the American Concrete Institute (ACI), mechanic systems and components under the standards of the ASME Code Section III, Division I and USNRC Regulatory Guides 1.20, 1.46, 1.60, 1.61, 1.92 y 1.122, among others.

Electrical and electronic components were constructed, fabricated and qualified taking into account the standards requirements of the Institute of Electrical and Electronic Engineers” (IEEE); the selection of special materials, welds, paints, etc. were performed in accordance with standards of the “American Society of Testing Material” (ASTM).

Other aspects such as the Pre-service and In-services Inspections of the coolant pressure boundary part components were carried out based on ASME Code, Section XI

and the assessment of the Quality Assurance Programs based on standards from the "American National Standards Institute" (ANSI), Series ANSI N45.2.

18.2 DESIGN ASPECTS

LVNPS, owned by CFE, is located at "Punta Limon", Municipality of "Alto Lucero" in the State of Veracruz.

LVNPS consists of two units, each one having a direct nuclear steam supply system (NSSS) known as boiling water reactor (BWR) and supplied by General Electric of the United States of America. The containment is Mark II of the pressure suppression type.

The nuclear system operates by a direct water cycle, which recirculates in the reactor vessel.

The reactor vessel is fabricated of a steel alloy having low carbon content and an inner liner of stainless steel except for the top head.

Fuel is slightly enriched uranium dioxide in form of small ceramic pellets contained in metallic tubes of a Zirconium alloy base. The total core holds 444 fuel assemblies; the fuel design has been modified in accordance with technical advances in this field, maintaining safety standards relative to the generation of lineal heat and peak factors.

Reactor control is carried out by means of 109 cruciform rods containing boron carbide as a neutron absorber. Insertion mechanisms are located at the inferior part of the reactor vessel.

LVNPS units 1 & 2 have similar characteristics to other installations built in the USA, such as Columbia Generating Station (formerly Washington Nuclear Power 2), La Salle 1 & 2, Nine Mile Point 2 and Susquehanna which have been in operation since the 80's.

General Electric has been the company responsible for the design, fabrication and supply of the nuclear steam supply system of both units. It has provided direction and consulting during the installation and start up of the equipment, continuing to this day as a consultant. The turbo-generator unit was fabricated and mounted by the Mitsubishi Company of Japan, the company assists in modifications and major maintenance.

The changes and design modifications are made in accordance with 10 CFR 50.59.

18.3 IMPLEMENTATION OF THE PHILOSOPHY OF DEFENSE IN DEPTH

The maintenance barrier integrity to avoid the release of radioactive material was adopted from the siting selection, conceptual and specific design stage including LVNPS construction.

The focus covered three levels:

- **Level One:** LVNPS has been demanded a high level of reliability to prevent the occurrence of abnormal situations by means of the incorporation in the design of the redundancy and diversity necessary to guarantee that critical functions (reactivity control, core cooling and control of radioactive material) are permanently guaranteed, relying for this purpose on methodologies such as quality assurance and the capability of important systems to be tested and inspected.

- **Level Two:** LVNPS postulated that despite the care adopted in Level One, occasional abnormal situations should arise; therefore, all necessary devices should be incorporated in the design to avoid such situations from becoming an accident.

  Level One and Two were evaluated in Chapter XV of the Final Safety Report and in the PSA Level 1 & 2 (Individual Plant Examination).

- **Level Three:** The presence of a very low probability event exceeding design basis is supposed, resulting in damage to the core and release of radioactive material to the environment. Developing and implementing the External Radiological Emergency Plan (PERE) performed a practicable application of this level.

18.4 LVNPS DESIGN CRITERIA AND STRUCTURE, SYSTEM AND COMPONENT CLASSIFICATION

18.4.1 General Design Criteria

The General Design Criteria employed by LVNPS are the following:

a) Residual heat removal systems are provided with sufficient capacity and an adequate operation to remove the heat generated in the reactor for the totality of normal operation conditions and abnormal operational transients.

b) Backup heat removal systems are provided to remove decay heat generated in the reactor under inoperable conditions of normal heat removal systems. The capacity of these systems must be adequate to prevent damage to fuel cladding.

c) Fuel cladding in conjunction with other systems are designed to remain with integrity in such way that any failure will be within the acceptable limits considering the totality of normal, and abnormal transients conditions of operation.

d) Control equipment is provided to enable the reactor's automatic response to fuel changes and abnormal operational transients.

18.4.2 Safety Design Criteria

LVNPS was designed following standards approved for nuclear installations.

LVNPS was designed and erected in a manner that the release of radioactive material to environment does not exceed the limits and values determined in the applicable standards and regulations in relation to normal operation releases, abnormal transients and accidents.

1. The reactor core is designed in such a way that it's nuclear characteristics does not contribute to the generation of a divergent power transient.

2. The reactor is designed to not present a tendency towards divergent oscillations of any of the operation parameters, considering for this, the interaction of the reactor with other LVNPS systems.

3. Installations for disposal of solid, liquid and gaseous waste are designed so that discharges of radioactive effluents and the transportation of radioactive materials off-site can be performed in accordance with the standards and regulations established by the Regulatory Body

4. The Main Control Room's design provides a means to be able to determine that the reactor is operated within envelop conditions considered in the Safety Analysis for LVNPS and to alert LVNPS operators when radioactive releases approach their limits.

5. Shielding are provided against radiation and access routes are established in a manner that allows duly trained operation personnel to control radiation doses within the limits established in applicable regulations.

6. Portions of the nuclear system forming part of the coolant pressure boundary are designed to maintain their integrity as a contention barrier for the radioactive material resulting from abnormal operational transients and accidents.

7. Safety-related systems and engineering safety features must function to ensure that the reactor coolant pressure boundary does not suffer damage from internal pressure produced by abnormal operational transients and accidents.

8. If an immediate and precise action is required in response to abnormal operational transients and accidents, such action is automatic, no decision or manipulation of controls is required by LVNPS operation personnel.

9. Essential safety actions are performed by equipment having sufficient redundancy and independence, so that no single failure of certain passive or active components impair the function required, even in certain long-term cases.

10. The control of safety and safeguards and engineering safety features system passive components is capable of being operated from the control room.

11. The design of the nuclear and safeguards and engineering safety features systems demonstrates its functionability.

12. The design of the nuclear and engineering safety features systems includes factors for considering natural environmental disturbances such as, earthquakes, floods and storms that may occur at LVNPS.

13. The electric power reserve sources have sufficient capacity to energize all nuclear safety and engineering safety features systems that may require so.

14. The design incorporates electric power back up sources in order to allow for a prompt reactor shutdown and decay heat removal, under circumstances in which the normal auxiliary power is not available.

15. A primary containment is used to envelope the reactor system, using the concept of pressure suppression.

16. The integrity and leaktight of the primary containment may be tested periodically.

17. There is a secondary containment that completely envelope the primary containment. This secondary containment has a system to minimize off-site effects produced by any radioactive material release from the primary containment.

18. Primary and secondary containment's in combination with other engineering safety features systems limit radiological accident effects, resulting in radioactive material releases of a volume of containment inferior to prescribed acceptable limits.

19. In order to maintain the integrity of the primary containment posterior to an energy release accident occurrence within the same, means are provided to remove such energy.

20. Piping penetrating to the primary containment and which may represent a pathway of uncontrolled releases to environment are isolated automatically when the release

of radioactive material is imminent. Such isolation is executed punctually to limit radiological effects below the specified acceptable limits.

21. Emergency cooling systems to limit the fuel cladding temperature were designed in such a manner that such parameter is maintained at values inferior to limits given in 10CFR50.46 for loss of coolant accident events.

22. Emergency core coolant systems ensure the continuity of the reactor coolant for the total range of rupture sizes postulated in the reactor coolant pressure boundary.

23. Operation of the emergency core coolant systems is automatic when required, regardless of the availability of external power supplies or LVNPS' normal generating systems.

24. The control room is shielded in order to guarantee its habitability under any possible accident condition.

25. In case of inhabitability in the control room, it is possible to conduct the reactor from its rated operation power to cold shutdown conditions, using local controls and equipment available outside the control room.

26. Redundancy capacity is provided having functional independence for reactor shutdown, regardless of the normal reactivity control measures. This support system has the capacity to shutdown the reactor at any normal condition and from there, maintains the shutdown condition.

27. Fuel storage and handling installations are designed to avoid inadvertent criticality, maintain shields and cooling of spent fuel. Installations allow storing spent fuel during the plants operative lifetime.

28. Systems having redundant or backup safety functions are physically separated and arranged in a way that any believable event that could cause damage to a region of the nuclear island complex does not compromise the functional capacity of the system designed as a counterpart.

29. No equipment or systems required for the reactor's safe shutdown is shared between Unit 1 and Unit 2.

18.4.3 LVNPS Structure, System and Component Classification

In order of importance to safety, structures, systems and components at LVNPS are classified as follows:

Safety Class 1

Applying to reactor coolant pressure boundary components or core support structure, in which a failure may cause the loss of reactor coolant at a greater rate than the normal reposition system.

Safety Class 2

Applying to structures, systems and components in which processes and services are essential to:

- Reactivity control
- Maintain the core's cooling geometry
- Emergency core cooling
- Provide and maintain containment
- Remove reactor and core residual heat

Safety Class 3

Applying to structures, systems and components that:

a) Transfer or contain radioactive material that if released due to a failure in the component, would result in an exceeding 5 mSv whole body dose (500 mRem) at the site boundary or its equivalent to any part or organ.

b) Provide in an essential manner, support to any safety-related structure, system or component.

Class 1E

Applying to electrical and instrumentation & control systems essential for reactor safe shutdown, containment isolation, reactor core coolant and, reactor and containment heat removal or for preventing a significant radioactive material release to environment.

Seismic Classification

LVNPS-1 & 2 safety-related structures, systems and components designed to remain operable during and/or after a Design Basis Earthquake or Safe Shutdown Earthquake; these are defined as Seismic Category 1. Specifically instrumentation & control components as well as electric components considered Class 1E are required to be seismically qualified by means of tests and/or analyses. Such qualification minimizes the

possibility of failure of electric equipment/components and of instrumentation as a result of an earthquake occurring, which would appear as a common failure cause.

Environmental Qualification

Class 1E equipment and components are submitted to tests to certify their capacity in performing their safety function under normal, abnormal and environmental accident conditions specific to its localization, including: temperature, humidity, pressure, radiation, chemical sprinkling, and vibrations.

The methodology of qualification demonstrates that the equipment/components retain their functional capacity under accident conditions even at the end of their life service.

In the same way as the seismic qualification, this environmental qualification minimizes the possibility of common cause failure due to the environmental accident conditions described above.

In addition to the above, LVNPS considers structures, systems and components forming part of the fire protection system as important to safety. These serve to protect areas containing equipment important to safety and from process systems, which even though are not Class 1, 2 or 3, form part of the radioactive material pressure boundary.

18.5 PROVED VALIDITY OF LVNPS 1 & 2 DESIGN AND CONSTRUCTION

Subsection 1.3 “Comparison Tables” in the Final Safety Analysis Report ISSE/FSAR of LVNPS, underlines the main design characteristics of the plant. These important characteristics are compared with those of other Boiling Water Reactor installations. It is also determined that the design of these installations is based on approved technology obtained during the development, design, construction and operation of similar types of boiling water reactors. It is deduced from the data, characteristics and other information shown that LVNPS is an approved design and no characteristics were incorporated to the same to classify it as a “unique type”.

In general, the design of LVNPS-1 & 2 components, structures and systems was prepared applying methodologies and criteria accepted and validated by the industry.

Codes, specifications and standards used for the design are the same as those applied in the nuclear industry in the United States of America: LVNPS-1 & 2 Seismic Category I structures; mechanical components; instrumentation and control systems and electric systems.

All LVNPS-1 & 2 design, purchasing and construction activities have been performed according to requirements in CFE’s Construction Quality Assurance Plan. Particularly, Section 9 of this plan establishes criteria to be met for the optimal execution of the

constructive processes considered which due to their characteristics are considered “Special Processes”.

The construction finalized with the execution of a pre-operational testing program that consisted of transferring 168 systems from construction personnel to operation personnel. This program had the following purposes: guarantee that the plant was completed satisfactorily; that the construction was performed according to its design; that the systems and components of the plant had the same margins of design to respond to anticipated transients; and, that the procedures for operating the plant were adequate.

The stage of validity of the design and construction finalized upon the execution of the nuclear test program (start-up tests), which validated design suppositions and that the safety criteria and margins during transients were adequately incorporated to the systems.

18.6 CNSNS ACTIVITIES

CNSNS survey all LVNPS-1 & 2 design, purchasing, construction and test activities through the execution of assessments, inspections and audits as well as continuous witnessing through its Resident Inspectors. Any change modifying the fulfillment of the codes (for example, ASME Code, Code Cases) and standards has been approved by CNSNS.

During the design, construction, pre-operational test and start-up test stages, the Regulatory Body has exercised its authority to perform inspections, raise findings and demand corrective actions in order to avoid recurrence of deviations. Likewise, CNSNS has determined that the obligations as regards to standards involved were met during these stages.

Modification to the original design performed during the construction and pre-operational test stages were revised and approved by the Regulatory Body prior to awarding the Initial Fuel Loading Permit.

From the beginning of commercial operation of LVNPS 1 and 2, CNSNS has assessed the major modifications to the design of the systems, components and procedures related to safety that have been presented by CFE, and has witnessed the tests performed after the modifications.

18.7 RELIABLE OPERATION

In relation to the existence of reliable levels and methods of protection, refer to Article 10 in this National Report.

As regards to the consideration of human factors and a reliable operation, see Articles 12 and 19 respectively, in this National Report.

ARTICLE 19. OPERATION

19.1 ADMINISTRATION AND MANAGEMENT CRITERIA

Once nuclear safety levels are defined over the design, there is a need for criteria to be established to ensure that the construction, erection and testing stage of structures, systems and components are in accordance with design criteria and applicable standards, codes and standards, and quality requirements, according to its importance in nuclear safety, satisfying the corresponding regulatory requirements. Similarly, at the operational stage, it is required to continuously maintain and optimize the capability and quality of structures, systems and components important to safety during the installation's lifetime in order to ensure that the plant's operation does not represent an undue risk to public health and safety.

19.1.1 Construction Stage

At this stage, the main means for achieving the safety levels required was strict compliance with LVNPS' Construction Quality Assurance Plan (PGCC).

Compliance with PGCC requirements was applied both to the behavior of individuals and organizations.

The application of the PGCC is a means for guaranteeing, in a highly reliable manner, that structures, systems and components important to safety shall be built, installed, inspected and tested in conformance with applicable design specifications, codes and regulations.

19.1.2 Operation Stage

The following means have been implemented for the operation stage to maintain the installation at the highest safety levels required by the Regulatory Body:

- **Technical Specifications (ETO's)**

  The document that regulates the operation of nuclear installations within the limits deriving from the safety analysis is denominated Technical Specifications (ETO's). It is ruled by the 10 CFR 50.36.

  LVNPS was designed under criteria directed to avoid radioactive material releases to the environment. In order to demonstrate the adequacy of its implementation, accidents hypothetically postulated were analyzed and results were presented as part of the information in the Final Safety Analysis Report. This

served to establish safety parameters or limits and conditions that restrict the operation of the installation beyond the same.

The Technical Specifications for Operation were developed based on USNRC NUREG-0123, parameters identified in the FSAR and recommendations in standard ANSI/ANS 5.8.4 in which it is specified that:

a) Each nuclear plant license application must include in the request “Technical Specifications” proposed, bases and administrative controls.

b) Each license shall include Technical Specifications deriving from safety analysis and their evaluation by the Regulatory Body.

The ETO’s are incorporated in the Operation License and they contain guidelines and conditions under which the plant must operate. Compliance with the ETO’s ensures that the operation is maintained within the limits determined by the safety analysis. Any deviation requires corrective actions to be taken and immediate notification to the Regulatory Body. Sections that correspond to constitute the ETO’s are: Definitions, Operation Limit Conditions, Surveillance Requirements, Core Characteristics and Administrative Controls.

As part of the Operation License, a modification to ETO’s requires authorization of the Regulatory Body.

- **Maintenance of Safety Reports**

In order to assure that LVNPS-1 & 2 shall operate during their lifetime in conformance with the bases (Safety Reports), that served for awarding the License for Operation, all change/modification to the installation, procedures or execution of tests or experiments are submitted for a Safety Evaluation. The purpose for such evaluation is:

a) To review that all change proposed be covered by license bases; that is, by analyses, models, methods and suppositions made in Safety Reports. This way, it is ensured that these bases are not modified and therefore do not require previous approval of the Regulatory Body.

b) For those cases in which it is identified that the change proposed is not covered by the license bases, to ensure that approval of the Regulatory Body is required prior to the implementation of the change.

c) To identify whether the change proposed modifies or affects a Technical Specification, in which case previous authorization and the modification to the ETO´s shall be requested to the Regulatory Body.

d) To request a periodic summary report briefing each and every change performed, that due to their nature are not submitted to approval of the Regulatory Body previous to implementation, so that the Regulatory Body is informed of the nature of all changes.

This process allows maintaining the Safety Reports effective, implying that the operation of LVNPS-1 & 2 is always covered by the license bases as well as by ETO´s approved.

- **Periodic Safety Review**

This document provides a global view of plant safety, with the objective of determining the modifications that should be carried out in order to maintain a high level of safety. The objectives of this review are the following:

a) The extent to which LVNPS complies with the international safety standards and with the regulatory framework of the place of origin of the reactor.

b) The extent which the LVNPS license base remains valid.

c) The appropriateness to maintaining safety of the changes made until the next periodic safety review.

d) The safety improvements that should be implemented to resolve the safety issues that have been identified.

19.2 LVNPS SAFETY ANALYSIS AND START UP PROGRAM

19.2.1 Safety Analysis

In the original licensing process, Preliminary and Final Safety Reports were defined within the regulatory framework and according to the format requested by USNRC Regulatory Guide 1.70.

For the stage in which the original Operation License was granted to LVNPS, the Regulatory Body reviewed the FSAR taking advantage of the experience obtained from the review of the construction stage document. In the case of special topics, the Regulatory Body asks for support from IAEA experts provided through the Technical Co-operation Programs.

After this, in the operational stage, CNSNS reviewed and assessed the Safety Analysis for the 5% Power Uprate. This included almost all the issues that are covered in the Final Safety Analysis Report, Second Phase (FSAR/ISSE). The results of the evaluation were documented in the Safety Evaluation Report.

CNSNS witnessed each of the five increments in power, from 1% until reaching 105 %, to corroborate a stable behavior. The safety analysis with the total steam and new thermal power was performed as part of the safety analysis on the primary containment systems in case of a loss of coolant accident, inside and outside the containment.

19.2.2 Start up Program

As part of the obligation of compliance with USNRC Regulatory Guide 1.68, a start-up program was carried out at LVNPS. This program started with the initial fuel loading for which Technical Specifications were applied. The Putting into Service Program was divided into four main phases:

Phase I. Tests with Reactor Vessel Open (initial fuel loading)

Phase II. Initial Heating

Phase III. Power Tests

Phase IV. Warranty Tests

- **Test Conditions**

Within the previous mentioned test phases, the start-up program was sub-divided into 8 test conditions in which specific test for Structure, System and Component (SSC) were performed.

TEST CONDITION	CONDITIONS/REGION OF FLOW-POWER MAP
VA	From fuel loading up to the time of installation of the dry well cover.
CA	After installing the dry well cover and up until the reactor was settled at pressure and temperature rated conditions.
C1	Before and after synchronization of main generator at 5% to 20% of Rated Thermal Power (RTP), with reactor recirculating pumps at low speed and the control valve between the maximum and minimum position.
C2	After main generator synchronization, with a control rod pattern of 50% to 75% at or below the recirculating flow master control lower analytical limit, up to a 50% RTP.
C3	From 50% to 75% of the control rod pattern, above 80% of the core flow and within the maximum allowable valve control opening up to a

TEST CONDITION	CONDITIONS/REGION OF FLOW-POWER MAP
	75% RTP.
C4	At the natural circulating line and its intersection with the lines between 95% and 100% of rod patterns up to a 75% RTP.
C5	From the lines of 95% to 100% of the control rod patterns and between those of a minimum flow at the recirculating pumps' (control valve in minimum position) rated speed and 5% above the inferior analytical limit of the recirculating flow's automatic control up to a 75% RTP.
C6	Within 95% to 100% of RTP and between 95% and the maximum allowable flow through the core.

- **General Acceptance Criteria**

Three general acceptance criteria were established to validate the start-up tests:

a. Level 1 Acceptance Criteria

Failure to meet this level obliges the unit to be lead to an observant situation until considered satisfactory and safe based on test results previously performed.

b. Level 2 Acceptance Criteria

Failure to satisfy this situation does not require altering the test program or unit operation. It is recommendable to investigate adjustments required as well as analytical and surveillance methods

c. Level 3 Acceptance Criteria

Failure to satisfy this level does not require altering the test program or unit operation. Limits established under this category are related to individual component expectations or transient behavior of control loops. This level is not associated with vessel or fuel protection systems.

- **Start-up Tests Performed**

The number of start-up tests performed for each one of the tests conditions to verify Balance of Plant systems (VS) and System Test (ST) for the systems of the Nuclear Steam Supply System is shown below.

TEST CONDITION	(ST) TEST PERFORMED	(VS) TEST PERFORMED
Open vessel (VA)	15	3
Heating (CA)	28	11
Condition 1 (C1)	15	18
Condition 2 (C2)	21	36
Condition 3 (C3)	35	22
Condition 4 (C4)	6	-
Condition 5 (C5)	7	-
Condition 6 (C6)	47	40
Warranty	2	-
T O T A L:	**176**	**130**

The tests for Condition 4 of the LVNPS unit 2 were not carried out.

❑ **Tests for the 5% Power Uprate**

Due to the fact that under the power uprate condition neither the pressure at the RPV nor the reactor recirculation flow were affected, many of the start up test were validated by analysis of the test results during the initial start up testing for both units. However the change in the main steam flow required the following tests to prove the stable operation under this new condition:

- Stable behavior for normal operation
- Stable operation of the Reactor Core Isolation Cooling System (RCIC)
- Thermal limits evaluation and calibration of feedwater flow transmitters for each power step from 100% up to 105%.
- Pressure Regulator EHC (including regulator failure to verify the transference to the backup regulator)
- Feedwater Control and Feedwater System, stable RPV level control and operation
- Chemistry
- Isotopic Analysis

- Environmental radiological monitoring at the release and discharge points, inside the Restricted Area.

19.2.3 Regulatory Body Activities

Revision to Section 14 “Test Programs” in FSAR was performed to determine the capability of the initial test program for LVNPS-1 & 2 as well as the evaluation of the execution of such tests and verification of the acceptance of the final results from a point of view of safety. All the above, as a requirement for the initial authorization of the operation of both LVNPS units.

In order to establish a very strict control over the performance of tests and over the power increase program and so to have no doubt about the reliability of the steps and the decisions made on the route to 100% of power, CNSNS established a requirement through which different power stages would be subject to an evaluation of LVNPS’ behavior as regards to the tests performed at the preceding stage. From here, it was established that LVNPS had to achieve authorization from the Regulatory Body to carry on. This process, during the tests to be performed, ensured that LVNPS would maintain itself within the standards established by the acceptance criteria. If for some reason, these tests did not satisfy the acceptance criteria, the corresponding immediate analyses were demanded.

During the start-up phase, the Regulatory Body carried out 39 inspections to Unit 1 and 17 inspections to Unit 2. These inspections were intended to verify groups and activities related to the start-up tests, such as Instrumentation & Control, Reactor Engineering, Maintenance, Start-up Superintendence, Quality Assurance and Quality Control. Based on the above, the original Licenses for Operation were awarded on August 24, 1990 for LVNPS-1 and April 10 of 1995 for LVNPS-2.

For the 5% Power Uprate condition, the Regulatory Body evaluated and authorized the testing program for both units of LVNPS. The safety related tests were witnessed by CNSNS in order to verify that the expected values for safety and operational parameters were obtained as described in the Safety Analysis. As a result of the evaluation and analysis of the results, CNSNS determined LVNPS had a stable behavior and that it could operate in the 5% Power Uprate Condition. Finally the Department of Energy granted the new Operation Licenses in December 8, 1999 for both units of LVNPS with the same expiration date as the original ones, that is July 24, 2020 (Unit 1) and April 10, 2025 (Unit 2).

19.3 USE OF APPROVED PROCEDURES

As described in Article 13 of this National Report, all activities important to safety related to the operation of LVNPS-1 & 2 are developed under strict adherence to the Quality

Assurance Operation Plan (PGCO). This obliges to the use of procedures approved by qualified personnel.

For control of all activities ruled by the PGCO, LVNPS has divided its procedures into the following groups.

a) Administrative Procedures

b) Operation Procedures subdivided into General Operation, System Operations, Abnormal Operation, Alarm Response, Emergency Operation, and Operation Verification.

c) Maintenance Procedures divided into Preventive, Corrective, Refueling Outages, Special Processes and Generic Maintenance.

d) Reactor Engineering: Reactor Verification, Reactor Analysis and Fuel Handling.

e) Radiological Protection: Radiological Protection (Generic) and Reduction in Personnel Exposure (ALARA).

f) Internal Emergency Plans.

g) Instrumentation: Instrumentation Maintenance and Instrumentation Verification.

h) Chemistry and Radiochemistry.

i) Material Control

j) Security

k) Training

l) Quality Control: Quality Control Generic Activities, Non-destructive Examination and Functional Tests.

m) Document Control

n) Fire Protection, and

o) Programming and Results Planning.

19.4 PROCEDURES FOR OPERATIONAL INCIDENTS PREDICTED AND ACCIDENTS

❑ Abnormal-Operation Procedures

An evaluation was performed on the design of LVNPS-1 & 2 to verify its response against foreseen operational incidents and accidents considered as design basis. These are classified in five categories as follows:

CATEGORY	TYPE OF EVENT	OCURRENCE EVENT/YEAR
I	Normal Operation	Normal
II	Expected Transients	1 – 1/20
III	Infrequent Transients	< 1/20 –1/100
IV	Design Basis	1/100 – 1/10,000
V	Special	N/A

- **Emergency-Operation Procedures**

As a result of the accident at Three Mile Island Nuclear Power Plant in the USA, the Regulatory Body requested CFE to review existing procedures for handling transients and accidents. This motivated the application of Emergency Procedure Guidelines to LVNPS-1 & 2 that were developed in a generic manner for BWR reactors by the BWR Owner's Group (BWROG) of which CFE forms part. These procedures for emergency response conditions are based on plant symptoms and are the initiators for response actions.

Modifications to the units' design basis are not required to incorporate Emergency Procedures (PE's) and these are in no way design basis considerations, but guidelines to respond to conditions far beyond license basis.

CFE developed Emergency Procedures for LVNPS using guidelines in NEDO 31331 "BWR Owner's Group Emergency Procedures Guidelines" and for which Control Room personnel have received complete training on their use.

19.5 TECHNICAL SUPPORT SERVICES DURING INSTALLATION'S LIFETIME

Technical support services for the operation of LVNPS-1 & 2 are provided by GCN organizations and include Design Engineering, On-site Support Engineering and Planning, additionally the GCN counts with other Departments as Radiation Protection, Licensing and Quality Assurance which are not directly related to the obligation of producing electric energy, being the objective to guarantee the safety conditions of the installation, that of the workers and environment, from the installation owner's point of view.

In addition, technical support has been developed throughout the country within national institutes (ININ and IIE) in support of LVNPS' operation and such institutes count on a technological infrastructure to continue doing so. Likewise, an industry for rendering professional services and supplying services in the nuclear field has been created.

19.6 NOTIFICATION OF INCIDENTS

According to the regulatory framework, LVNPS must report to CNSNS the occurrence of all incidents covered by categories defined in 10 CFR 50.72 and 10 CFR 50.73 using the format identified as *"Notification of Reportable Event"* (NER). This format includes a summary of the event, immediate corrective actions, core emergency cooling system and engineered safety features conditions as well as information on radiological conditions.

This notification is sent to the On-site Resident Inspector as well as to the Regulatory Body's headquarters. According to the importance of the incident is whether the notification is to be sent immediately, within 1 hour or within four hours.

In compliance with 10 CFR 50.73, LVNPS must send a *"Licensee Event Report" (LER)* within 30 days after the occurrence of the event to completely describe the event, the result of the root cause analysis and corrective and preventive actions proposed.

In order to improve the root cause analysis of events, GCN created a group with sufficient experience and specialization in root cause analysis in 2000.

19.7 OPERATIONAL EXPERIENCE

19.7.1 Internal Operational Experience

GCN has developed a specific program to review Internal Operational Experience at LVNPS-1 & 2, in order to ensure that such experiences are incorporated as corrective actions to avoid recurrence as well as to improve the safety and reliability of LVNPS units.

This program includes all abnormal events evaluated and reported by any organization of the GCN, mainly by those related to its operation. Under this context, the scope of the program covers the event's investigation, its analysis to determine the root cause, definition of corrective actions (corrective and preventive).

In addition to the events that due to their nature generate a LER, LVNPS has decided to analyze other events which, although they do not reach the category for being notified to the Regulatory Body, are of importance because of their consequences on the reliability

of LVNPS-1 & 2. These analyses were originally denominated “Internal Event Report” (REI), among these, the following can be mentioned:

- Unplanned decreases in power >10%
- Unplanned ½ SCRAM (during operation or start-up)
- Unplanned ½ isolation (during operation or start-up)
- System or component inoperabilities, which oblige to request an Exception to ETO’s to avoid unit shutdown.
- Any other having important consequences for reliability such as, damage to equipment having impact on plant reliability factors or sensible systems; unplanned radioactive releases on or off-site; release of explosive gases at the plant; mistakes (non-assigned tasks, outages, jumpers or badly installed/removed disconnection’s, applying procedures, etc.)

To date this concept no longer applies and now Condition Reports are generated.

19.7.1.1 Containment performance

A testing program to measure the primary containment leakage prior to initial operation of the LVNPS Units 1 and 2 and periodically throughout its operating life has been applied. The testing program has included the performance of Type A test to measure the overall integrated leakage rates, Type B test to detect and measure local leakage from certain components, and Type C test to measure containment isolation valve leakage rates.

These leakage tests are performed in accordance with the requirements of Appendix J of 10 CFR 50, “Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors”.

Type A tests are performed using the Absolute Method. A makeup verification test is performed as a supplemental test. The pressure detectors, temperature sensors and dew point sensors are in accordance with the characteristics established in the ANSI ANS-56.8/1987.

Acceptance criteria for the preoperational and periodic leak rate tests are based on the 10 CFR 50, Appendix J. The peak pressure test performed at the calculated peak containment accident pressure (37.0 psig) is acceptable if the total measured containment leakage rate does not exceed 75% of the maximum allowable leakage rate. During the periodic tests, the local leakage tests are performed so that repairs can be accomplished to reduce the total leakage within the acceptance criteria.

19.7.2 External Operational Experience

For a better scattering of recent external events in the nuclear industry, a selected number of them are being translated into Spanish and included in a bulletin of operational experience that is transmitted regularly and is available through the Nuclear Power Plant Division (GCN) electronic system (INTRANET) to the plant personnel. Additionally, the Just In Time (JIT) bulletins from WANO/INPO that are applicable to BWR are translated into Spanish and in accordance with the Nuclear Power Plant Division policy they are discussed in work meetings and used to continuously expand the electronic internal net (INTRANET) with documents in Spanish.

Besides that described in the previous section, GCN has implemented since the Initial Fuel Loading at LVNPS, an acquisition and review program of external operational experiences. Its purpose is to ensure that experiences in the nuclear industry applicable to LVNPS be incorporated as corrective actions to improve the safety and reliability of the same. Basically, the scope of this program includes experiences from the following sources: INPO, WANO, General Electric, Salesman and Engineering Architects, US Nuclear Regulatory Commission.

19.7.3 Regulatory Body Activities

The CNSNS reviews event reports submitted by LVNPS in compliance with regulations established. When an event important or of special interest to safety occurs, CNSNS carries out an in-depth evaluation and investigation of its causes, impact on safety, the existence of recurrent events and, when required, question or impose the scope of the corrective actions, and/or the deadline for its conclusion. CNSNS also analyzes if the event relevance requires a special inspection. For the analysis of reportable events, CNSNS develops statistics to determine trends on the event type, root cause, recurrences, etc. in order to define if, as result of these, some regulatory action is required.

The Regulatory Body takes part in the “Incident Reporting System” – IRS of the NEA, in order to share operational experience of the Mexican nuclear installation with member countries in the international community, as well as gather and implement the experience of others in Mexico.

Also, CNSNS participates periodically in reunions about the International Nuclear Event Scale, INES.

19.8 RADIOACTIVE WASTE TREATMENT SYSTEMS

This section describes design capability and characteristics to control, handle, store and dispose of liquid, solid and gaseous waste resulting from the operation of the plant and which contain, or constitute, or are contaminated with radioactive material.

There are three radioactive waste treatment subsystems that correspond to one of the material phases: liquid, solid or gaseous wastes.

19.9.1.1 Liquid Waste Treatment

The Liquid Radwaste System (LRS) provides for collection, storing, processing and controlled release of radioactive and potentially radioactive liquids associated with the operation of the nuclear power plant. The discharge of treated waste is controlled and monitored the quantity of radioactive material to ensure that any discharge is As Low As Reasonably Achievable (ALARA) and in conformance with the requirements specified in 10 CFR 20 and 10 CFR 50 including the dose design objective specified in 10 CFR 50 Appendix I. The LRS is design to collect essentially all potential radioactive waste produced by the plant operation and by processing the radionuclide concentration is reduced upgrading its quality to permit its reuse or discharge to the environment. The LRS for each unit is divided into six subsystems designed to segregate the various type of liquids and semi liquids radwaste base on their composition and process requirements. These subsystems are: Equipment and floor drains, chemical and regenerating wastes, detergent wastes and solidification preparatory. The processing of liquid radwaste is performed in the Radwaste and Purification Building on a batch basis.

Liquid treatment subsystems allow processing of all fluids that for diverse reasons come from the system containing the same, and require for analyzing and treating. These subsystems are classified according to the quality of the liquids they process: floor and equipment drains, chemical and regenerating wastes, detergent wastes and preliminary solidification process.

Equipment drainage subsystems are those capable of processing low conductivity- high activity liquids coming from equipment handling potentially contaminated liquids at LVNPS and from the backwash of filter and demineralizer resins used for cleaning condense water. As regards to the subsystem's design capacity, 10% of the quantity processed shall be released to environment in a controlled manner combined with the condenser cooling water outlet flow (28.5 m^3/seg). Ninety percent (90%) of remaining liquids treated shall be reused by LVNPS as condense reserve.

The floor drains subsystem processes high-conductivity liquids although these liquids are low-activity. The margin of design against daily process needs is of roundabout 20 times, having the purpose of accepting common surges during LVNPS start-up after a cold shutdown.

Another source of production of contaminated liquids is the laundry, since work clothes of employees working in restricted areas are washed there. Also, processed liquids are used in cleaning solid waste containers as well as solutions used in decontaminating external components.

Regenerating waste and preliminary solidification subsystems are two additional contaminated liquid sources. The first subsystem collects and treats regenerating solutions from demineralizing resins and the second subsystem collects concentrated solutions from evaporators.

The design of the buildings containing tank and sampling recipient systems for the aforementioned subsystems as well as piping systems connecting the same, satisfy design basis to support Operation Basis Earthquake without damage.

19.8.2 Gaseous Waste Treatment

Gaseous treatment systems are designed according to the origin and radiation levels expected in the extraction and ventilating systems at LVNPS: off-gas, turbine steam seals and ventilation of buildings.

It has been verified that the off-gas treatment system is designed to collect and delay exhaustion of noble gases produced by fission, which are removed from the condenser by means of steam jet ejectors. The noble gas process continues through a hydrogen recombiner, 10-minute retention tanks, and pre-filter systems, activated carbon beds and high-efficiency air filters and then, finally, through a ventilating air current, monitored to the atmosphere.

This system's hydrogen recombiner is designed to support the postulation of hydrogen explosions (generated by radiolysis). It has high concentration alarm detection, which alert the main control room operator if the recombiner has problems so it is isolated and the redundant train is put into service.

Environmental dosimetry studies performed considering LVNPS in operation have demonstrated that design basis suppositions of gas treatment systems are adequate. Based on the above, it is considered that gas treatments satisfy their function of limiting the release of radioactive material in a gaseous form.

19.8.3 Solid Waste Treatment

This subsystem is designed to collect and process humid and dry wastes generated at LVNPS in order to be able to confine them in a safe and reliable manner inside containers appropriate for its eventual isolation. These can be stored in steel containers or high integrity high density polyethylene containers.

19.8.4 Spent Fuel Storage

The storage pool (one per LVNPS unit) was originally designed (in 1972) for a capacity of just 580 fuel assemblies, for an 18-month storage capacity. Towards the end of 1989, analyses were performed for an arrangement of fuel racks in the storage pool, based on the use of steel racks having special receptacles to retain Boron. LVNPS presented an

analysis to the Regulatory Body, who after evaluating the heat removal capacity from the pool cooling systems as well as the sub-criticality factor, gave authorization to increase the capacity of each storage pool to up to 7.16 cores (3177 fuel assemblies), from which 6.16 cores (2733 assemblies) are designated for routine storage and a complete core for emergency situations. The above cited represents a storage capacity for the total estimated operational lifetime of LVNPS.

19.8.5 Radioactive Waste Production-Reduction Program

With respect to a reduction in the volume of radioactive waste, up to this day, LVNPS is carrying out the following actions: For dry solid waste – compacting with a 3 to 1 reducing ratio. In the case of process waste (sludge), cement and asphalt as well as for resins, these are introduced into high-integrity containers (HIC's).

As for minimizing radioactive waste, LVNPS is currently applying and improving the corresponding administrative controls in order to optimize the use of protective clothing and equipment as well as to minimize the amount of rubbish generated in radioactive zones.

As part of the radioactive waste reduction and minimization activities, LVNPS initiated a Dose Reduction Program. It included among other activities: injection of Zinc, removal of reactor vessel corrosion products, reactor recirculating system loop chemical decontamination, substitution of valve seats containing Cobalt generating material, installment of fixed and semi-fixed shields, etc.

In relation with LVNPS radwaste generation minimizing processes, several strategies are being putting in place, some of them are:

- Increase in the liquid waste treatment processes efficiency in order to increase water re-use, diminishing the liquid effluents discharges.
- Degradable materials utilization made out of a special polymer of polivinyl-alcohol to substitute, mainly, cotton materials of radiological protection clothes and decontamination accessories, which can be dissolved totally in hot water reducing considerably solid waste volume to be treated. Because decontaminated cotton materials have become the biggest contributor to generation of compactable solid waste stored in the DRSS, their substitution for soluble materials will contribute to reduce the generation of this type of waste.
- Efficient segregation of non-compactable solid radwaste (metallic waste) through decontamination processes, cut and grinding. It is being considered in to implement a decontamination process using chemical agents.
- Reinforcement in the personnel's awareness for the optimization of protection accessories use and work effective times, with the purpose of using the minimum required of these accessories.

- Improvement of wet solid waste drying processes.
- Optimization of the use of accessories for radiation protection that consists on the effective dose equivalent assessment in function of the protection accessories optimization that could reduce worker's efficiency in areas with radiation. This point is applied for dose reduction and support to waste generation reduction purposes.

19.9 AGING MANAGEMENT AND PLANT LIFE EXTENSION

Different programs for controlling the aging of mechanical components are: In Service Inspection, Operability of Pumps and Valves, Augmented In Service inspection to specific mechanical components (pipes, snubbers, etc.). Specifically as a preventive measure for the reactor internals and coolant pressure boundary care, there is an augmented inspection program for reactor internals and activities have been programmed to improve water chemistry.

In conformance with the Laguna Verde NPS Operating License, there are two programs: environmental qualification and maintenance of environmental qualification. These have as main objective to assure and maintain the qualification of the equipment important to safety during the design life of the LVNPS 1 & 2. These programs are oriented mainly to control the aging and accident environmental effects for the electrical, mechanical and instrumentation and control components. This control is important to assure the performance of the above mentioned components during after normal conditions and accidents, as well to avoid occurrence of common cause failures.

19.10 LVNPS-1 & 2 PERFORMANCE INDICATORS (PI´s)

Particularly, indicators related to safety and reliability are considered. Specifically the world’s nuclear community (WANO) as a means for collecting and exchanging operational experience uses such indicators. LVNPS-1 & 2 applies such operational experience as a means of comparison of performance with other similar plants and to emulate the best international practices.

These indicators are listed below.

Nuclear Safety

- RHR Unavailability
- Diesel Generator Unavailability
- High Pressure Injection System Unavailability
- Automatic SCRAMS x 7000 Critical Hrs.
- Chemical Index

- Collective Exposition to Radiation

Reliability

- Unplanned loss of Capacity