K.3 DOCUMENTATION

The following NFC Deliverables given in Appendix E are to be provided under the physics start-up program under NFC. NFC part and EPC part will cooperate together as to create one integral output

The above documentation shall satisfy requirements applicable for physics start-up testing presented in the Construction and Commissioning Document, Section 3.6.

Basically, EPC supplier will be responsible for all test procedures during commissioning including Physical Start-up Test in Active Testing. The test manual and test program along with the related document will be developed under the management of EPC supplier. The equipment for physics test will be supplied according to EPC Contract. The actual predicted data for physics test will be provided by NFC for each cycle. The Supplier is responsible to assure consistency between the relevant deliveries of EPC Contract and NFC.

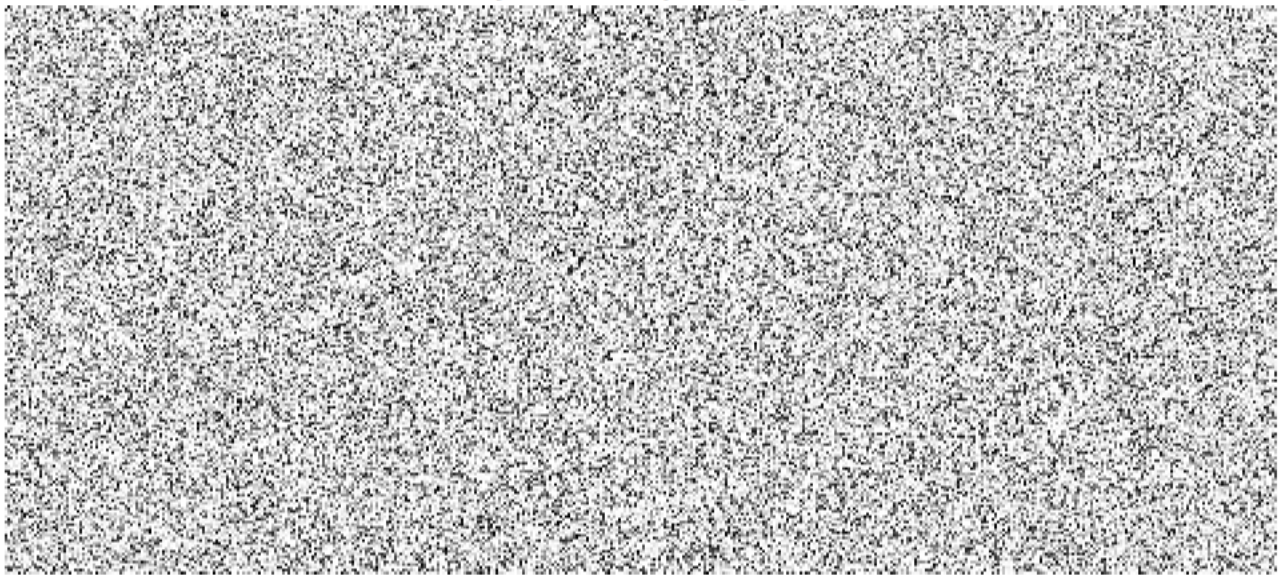
However, the requirements and the acceptance criteria along with related background knowledge including training for test operation will be provided based on Appendix J. The cycle specific input for physics test will be supplied by NFC supplier. It is also responsibility of NFC supplier to provide Technical Assistance during the physics test.

K.4 SCHEDULING

Physics start-up program will be a part of the general commissioning program. The testing procedures and related documents will be developed by the Supplier and will be subject to the Owner's review and approval.

The actual physics start-up data for each Cycle will be provided when the Core Design is completed with the as-built manufacturing data. The documents provided for physics start-up test are listed in the below Table K.4.1 and will be provided in accordance with Appendix E.

Table K.4.1 List of Document for Physics Start-up Program



NUCLEAR FUEL CONTRACT

APPENDIX L

DOCUMENT NAME:	NUCLEAR FUEL CONTRACT APPENDIX L

L - NUCLEAR MATERIAL

Owner is responsible for the supply of Nuclear Material for fabrication of the First Core Supply Batches and Reload Supply Batches as specified in Chapter 3 of the NFC. This Appendix L specifies in more detail the terms and conditions for calculation of quantities of Nuclear Material to be delivered, delivery of Nuclear Material to Supplier by an account-to-account transfer and by a physical delivery and an evaluation of balance in the Material Account.

L.1 DETERMINATION OF FEED AND SWU NEEDS

L.1.1 CALCULATION FORMULA

L.1.2 CALCULATION TAILS ASSAY

L.2 DELIVERY OF NUCLEAR MATERIAL BY ACCOUNT-TO-ACCOUNT TRANSFER (Mode 1)

L.2.1 DETERMINATION OF ASSAYS AND QUANTITIES TO BE DELIVERED

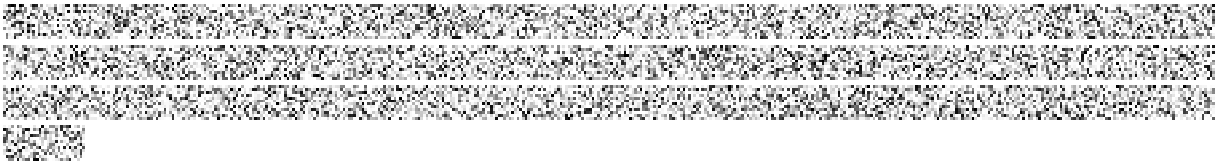
L.2.2 NOTICES AND INFORMATION EXCHANGE

L.3 DELIVERY OF NUCLEAR MATERIAL BY PHYSICAL DELIVERY (Mode 2)

L.3.1 DETERMINATION OF ASSAYS AND QUANTITIES TO BE DELIVERED

L.3.2 DELIVERY CONDITIONS

L.3.2.1 EUP Transport cylinders and packaging sets



[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

L.3.2.2 EUP samples and its packaging and delivery

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

L.3.2.3 Nuclear Material origin and other limitations

L.3.2.4 Import procedure and co-operation of the Parties

L.3.2.5 Not used

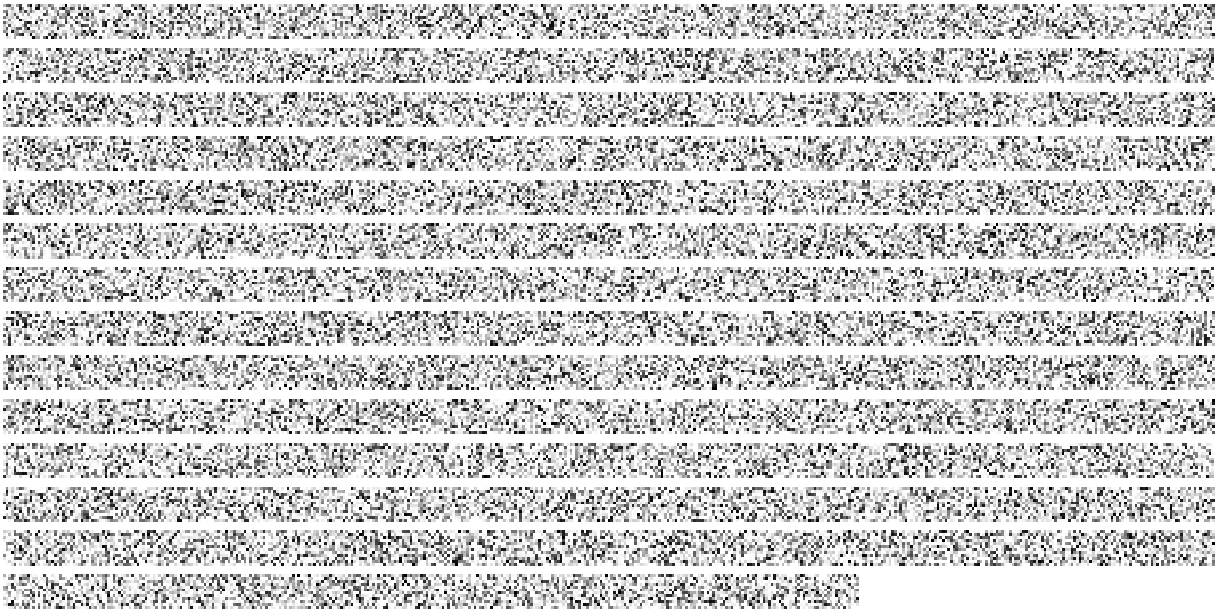
L.3.2.6 Nuclear Material handover procedure

[redacted]

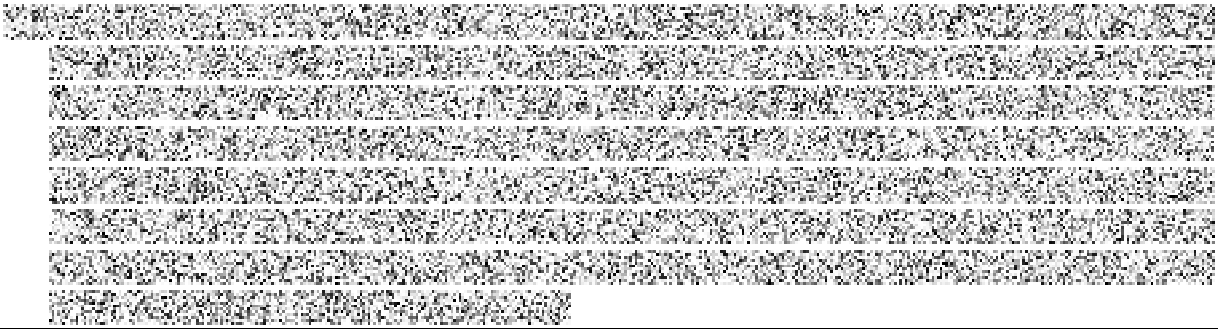
L.3.3 WEIGHING AND ACCEPTANCE PROCEDURE

L.3.3.1 Nuclear Material acceptance procedure

[redacted]

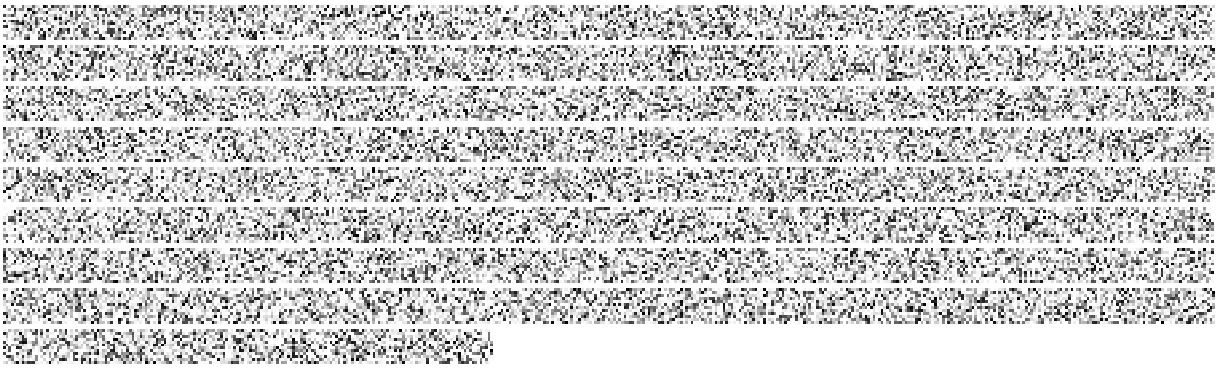


L.3.3.2 Resolution of disputes concerning Nuclear Material acceptance



L.4 NUCLEAR MATERIAL INVENTORY IN THE FABRICATION PLANT

L.4.1 LIMITATIONS ON INVENTORY OF NUCLEAR MATERIAL IN THE FABRICATION PLANT



L.4.2 TRANSFER OF NUCLEAR MATERIAL IN MATERIAL ACCOUNT TO A THIRD PARTY

L.4.3 BALANCE OF MATERIAL ACCOUNT AFTER THE TERMINATION OR EXPIRATION OF THE NFC

L.4.4

NUCLEAR FUEL CONTRACT

APPENDIX M

DOCUMENT NAME:	NUCLEAR FUEL CONTRACT APPENDIX M

M - FUEL ASSEMBLY AND CORE COMPONENTS FABRICATION INFORMATION

After each fabrication campaign of Fuel Assemblies and Core Components, Supplier shall provide to Owner the information listed in this Appendix M.

M.1 GENERAL INFORMATION ABOUT FIRST CORE SUPPLY BATCH OR RELOAD SUPPLY BATCH

M.2 GENERAL INFORMATION AND TECHNICAL DATA OF FUEL ASSEMBLY

M.3 FUEL ROD TECHNICAL DATA

M.4 GENERAL INFORMATION AND TECHNICAL DATA OF CORE COMPONENTS

The information related to Core Components is passed over together with each Core Components delivery according to the following list

General information and technical data of Core Component

Prior to the first Fuel Assembly and Core Component delivery under NFC, Parties shall develop a detailed definition of the information structure / format.

M.5 ADDITIONAL INFORMATION ON QUALITY MANAGEMENT, MECHANICAL, PHYSICAL AND CHEMICAL PROPERTIES OF FUEL ASSEMBLY AND CORE COMPONENT PARTS

The list of other quality management related information, mechanical, physical, and chemical properties of individual parts of Fuel Assemblies and Core Components is provided in this Part.

General information and technical data of Fuel Assembly

Information on parts and components of Fuel Assembly

[redacted]

Information on mechanical, physical, and chemical properties of Fuel Assembly parts.

M.5.1 FUEL ASSEMBLY

UO_2 Powder

[redacted]

Pellet

UO_2 Pellet

[redacted]

[redacted]

[redacted]

Fuel Rod & Gd Rod Assembly

[redacted]

Bottom End Plug

Top End Plug

Fuel Rod Spring

Fuel Tube

[redacted]

Fuel Rod & Gd Rod Assembly

[redacted]

Instrument Tube

[redacted]

Guide Thimble Assembly

Guide Thimble Tube

[redacted]

Guide Thimble End Plug

[redacted]

Flange

[redacted]

Guide Thimble Assembly

Top Nozzle Assembly

Top Nozzle Assembly

Top Nozzle Adapter Plate

Top Nozzle Holddown Plate

Outer Guide Post

Holddown Spring

Instrument Housing

Raw Material

Bottom Nozzle Assembly

Bottom Nozzle Assembly

Skirt & Leg Casting

Instrument Guide

[redacted]

Raw Material

[redacted]

Grid Assembly

Top & Bottom Grid Assembly

[redacted]

Mid & IFM grid assembly

[redacted]

Weld joint specimen

Skeleton assembly

Thimble screw

Mid & IFM grid sleeve

Inconel grid sleeve

Bottom grid insert

Dashpot tube assembly

Inner extension & top screw

Skeleton assembly

Fuel Assembly

Fuel Assembly

Fuel Assembly uranium weight table

Fuel Assembly quality traceability table

[redacted]

M.5.2 CONTROL ELEMENT ASSEMBLY

Tube

[redacted]

[redacted]

[redacted]

CRTA

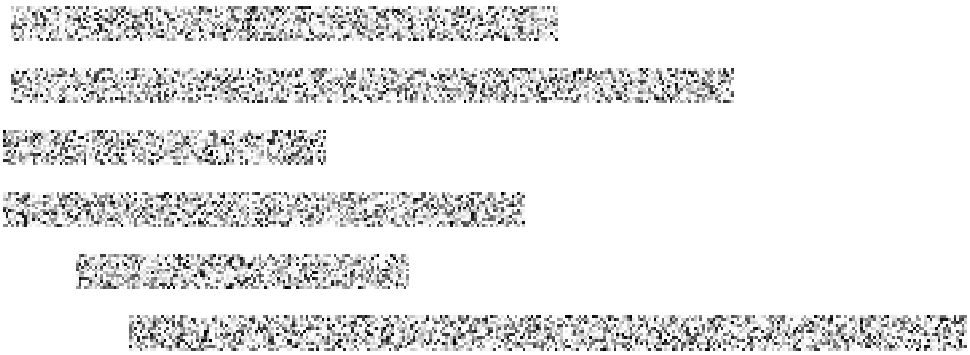
Spider

M.5.3 NEUTRON SOURCE ASSEMBLY

Dummy assembly

Secondary Source

End cap



Pellet

NUCLEAR FUEL CONTRACT

APPENDIX N

DOCUMENT NAME:	NUCLEAR FUEL CONTRACT APPENDIX N

N - DELIVERY DOCUMENTATION, TRANSPORT PACKAGES LABELLING, FORMS OF ACCEPTANCE/REJECTION NOTICES, ORDERS AND OTHER DOCUMENTS

N.1 FIRST CORE SUPPLY BATCH OR RELOAD SUPPLY BATCH TRANSPORT DOCUMENTATION

In accordance with Article 5.1.6 of the NFC, the Supplier shall submit to the Owner the following documentation relating to the delivery of Fuel Assemblies and Core Components (if applicable):
















N.2 MARKING – LABELLING OF TRANSPORT PACKAGES FOR NUCLEAR FUEL

In accordance with Article 5.1.5 of the NFC, the Supplier shall ensure that the Transport Packages for Nuclear Fuel and Core Components shall have externally posted on the Transport Packages the following information:

N.3 FORMS OF HANDOVER PROTOCOLS, ACCEPTANCE/REJECTION NOTICES AND OTHER DOCUMENTS

Forms of handover protocols, notices of acceptance / rejection and of other documents are provided in Figures below.

Form of New Fuel Assembly Inspection Record Sheet

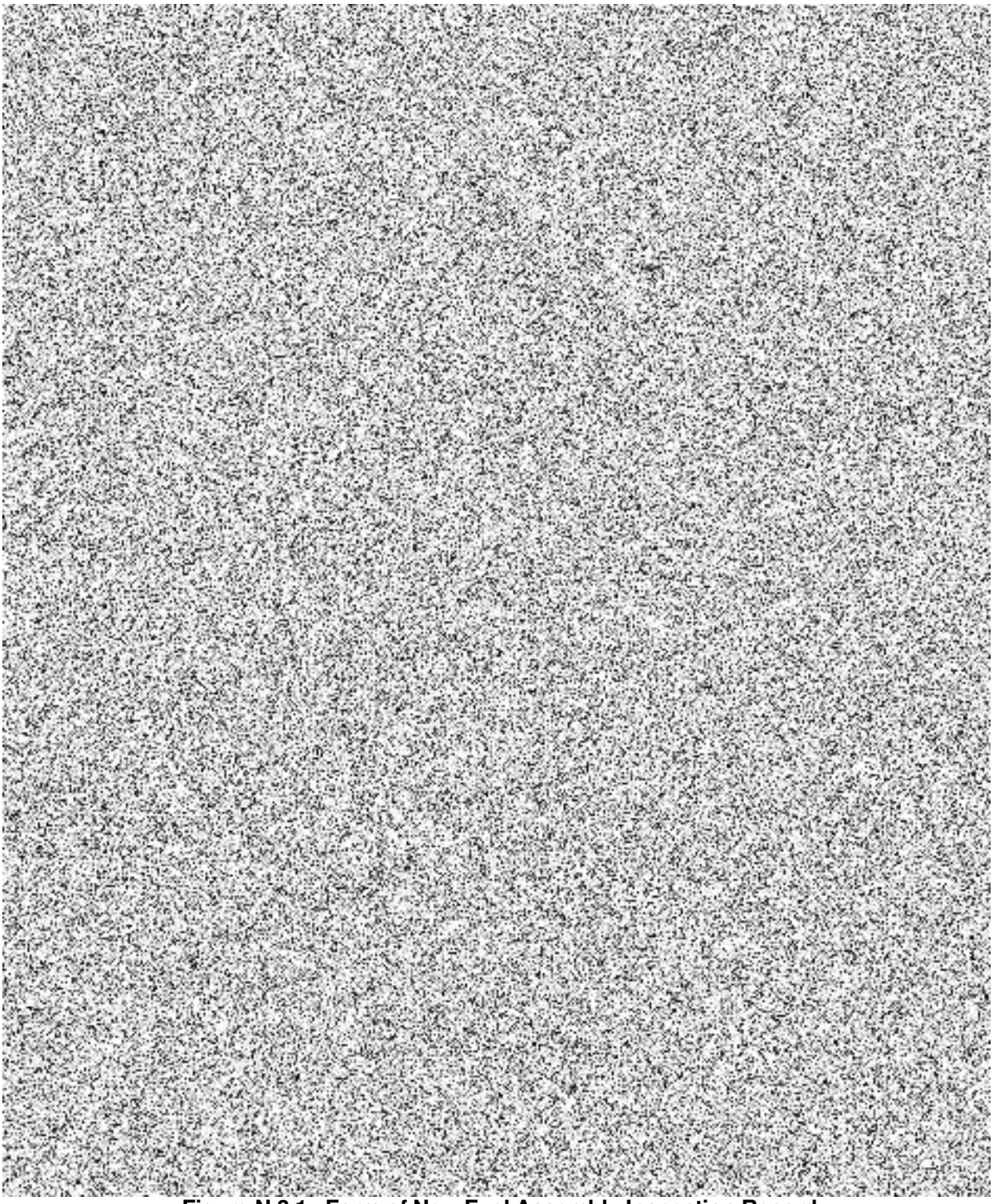


Figure N.3.1 Form of New Fuel Assembly Inspection Record

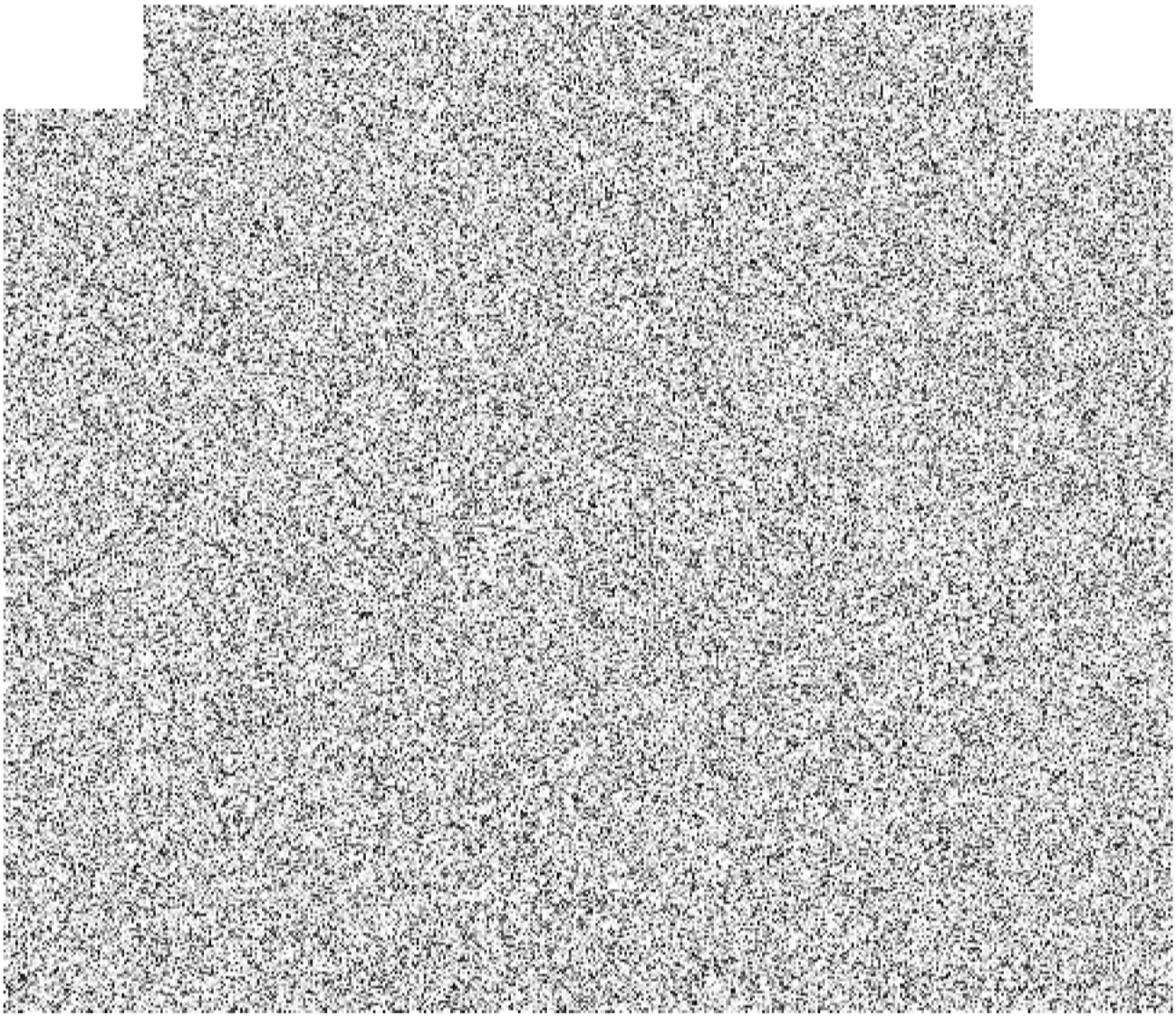


Figure N.3.2 Form of Handover Protocol

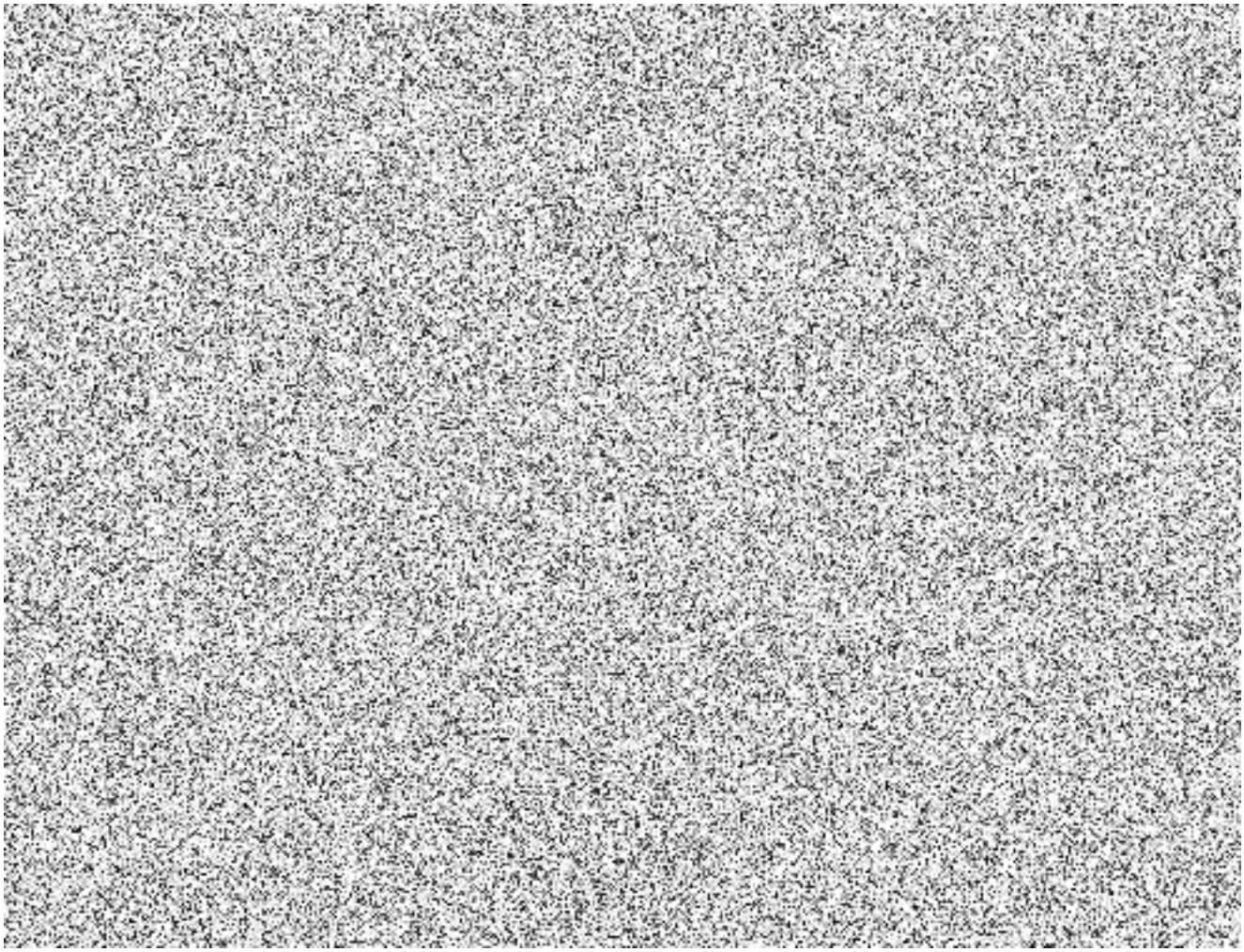
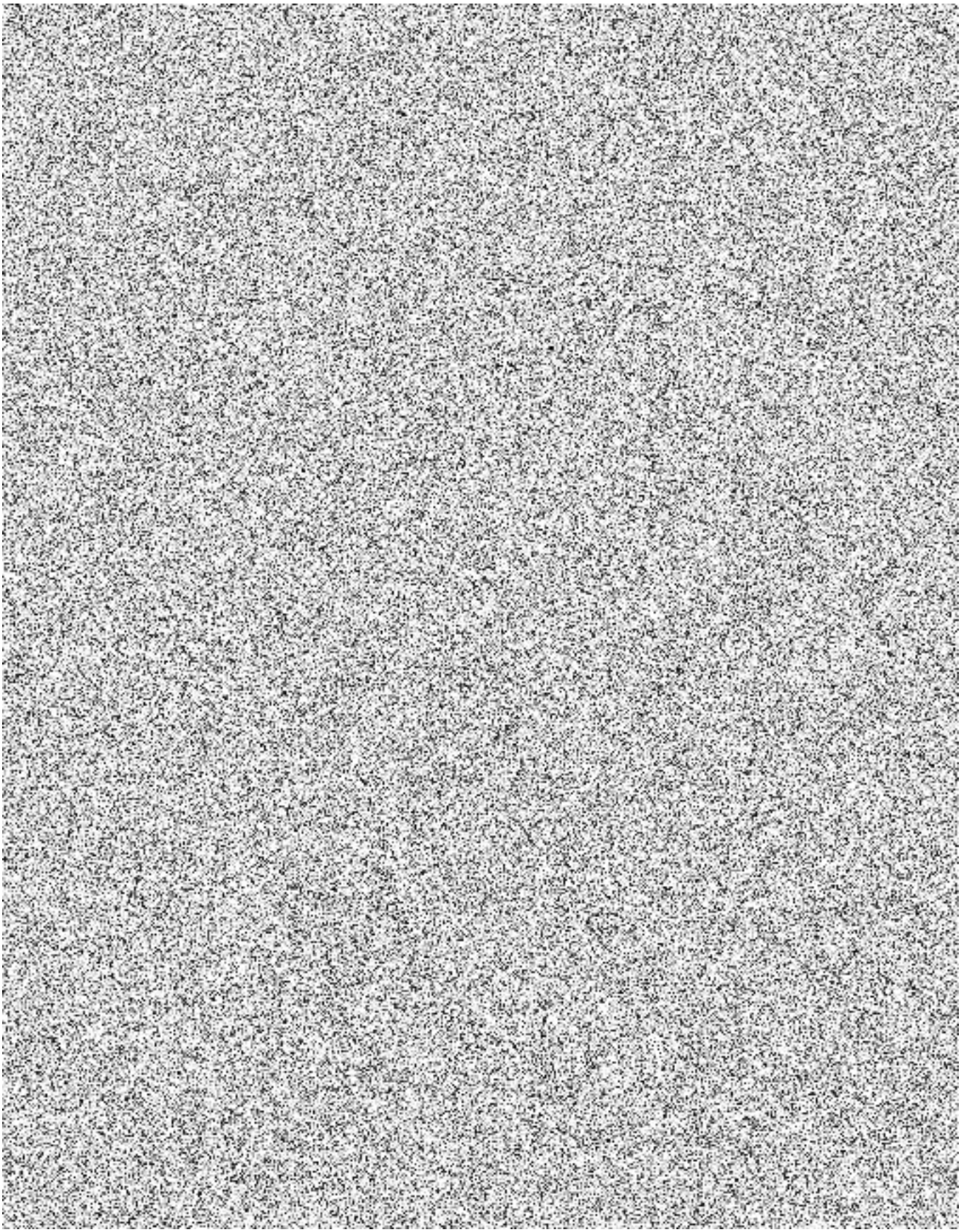


Figure N.3.3 Form of notice of Acceptance/rejection



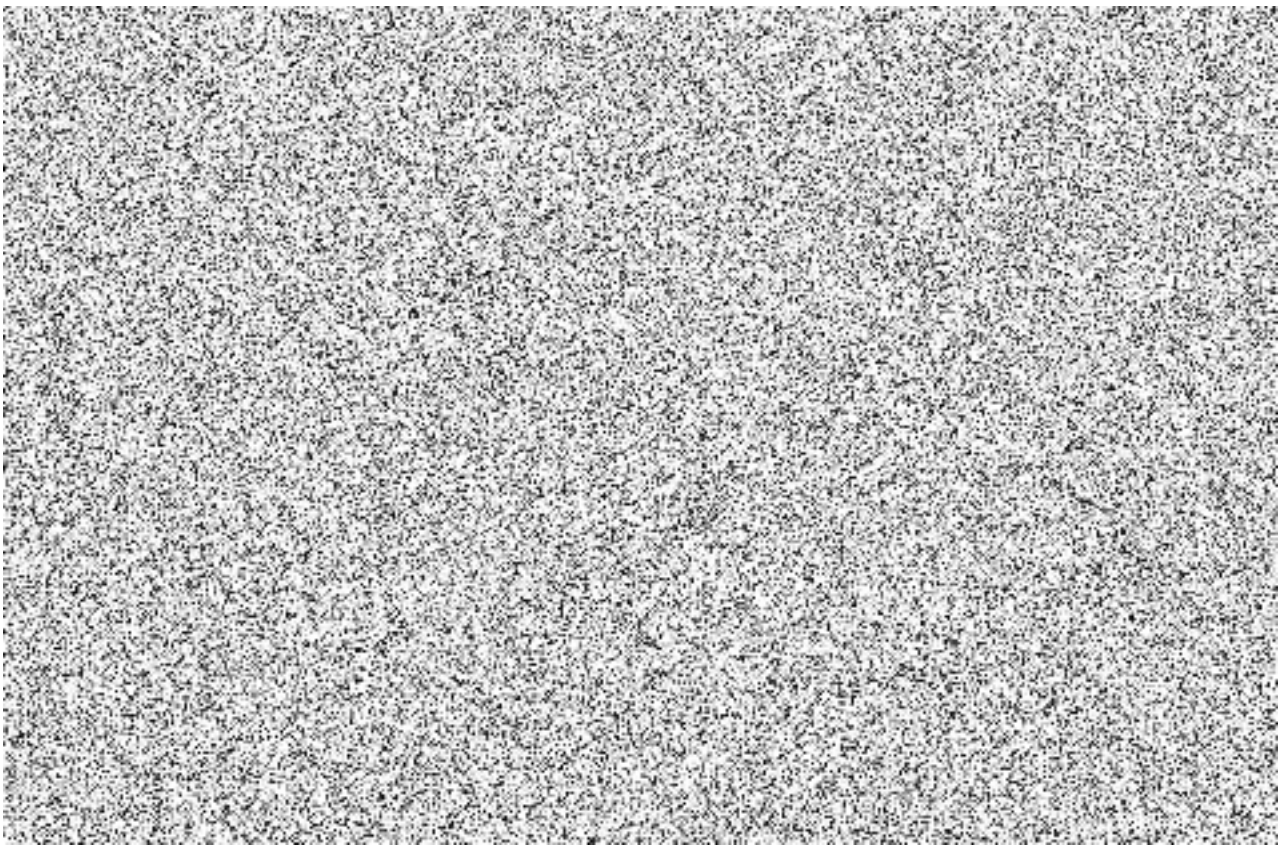


Figure N.3.4 Form of Equipment Repair Checklist

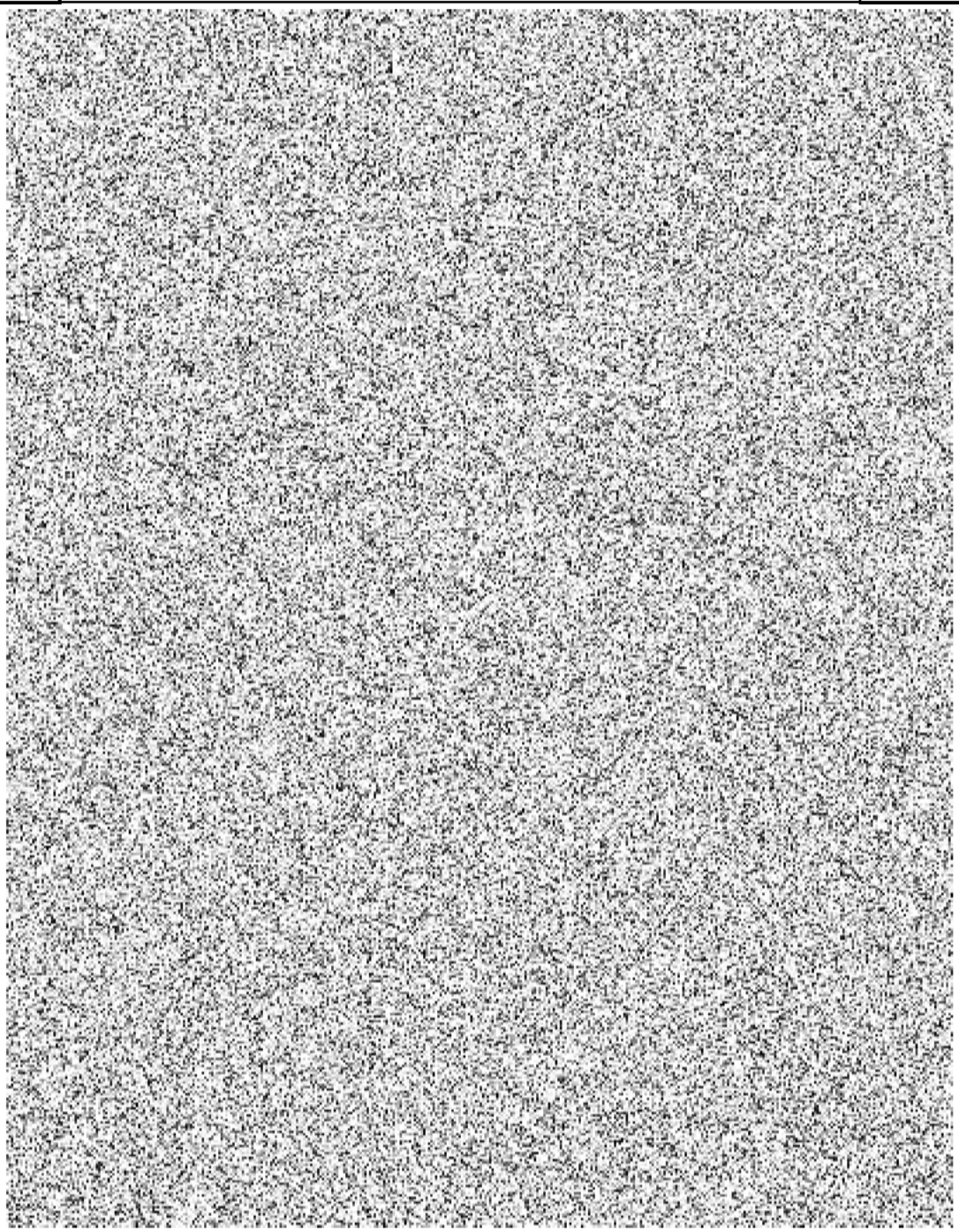


Figure N.3.5 Form of Fuel Repair Sheet

N.4 ORDER

For each Reload Supply Batch, the “Order” according to Section 7.2 of the NFC shall include at minimum the quantity, type, nomenclature and price of individual Fuel Assemblies, SDD, terms of delivery, contract number and Parties signatures (or only signature of the Owner if issued unilaterally). The “Order” may be also used for custom purposes.

Form of “Order” for a Reload Supply Batch is provided in Figure N.4.1.

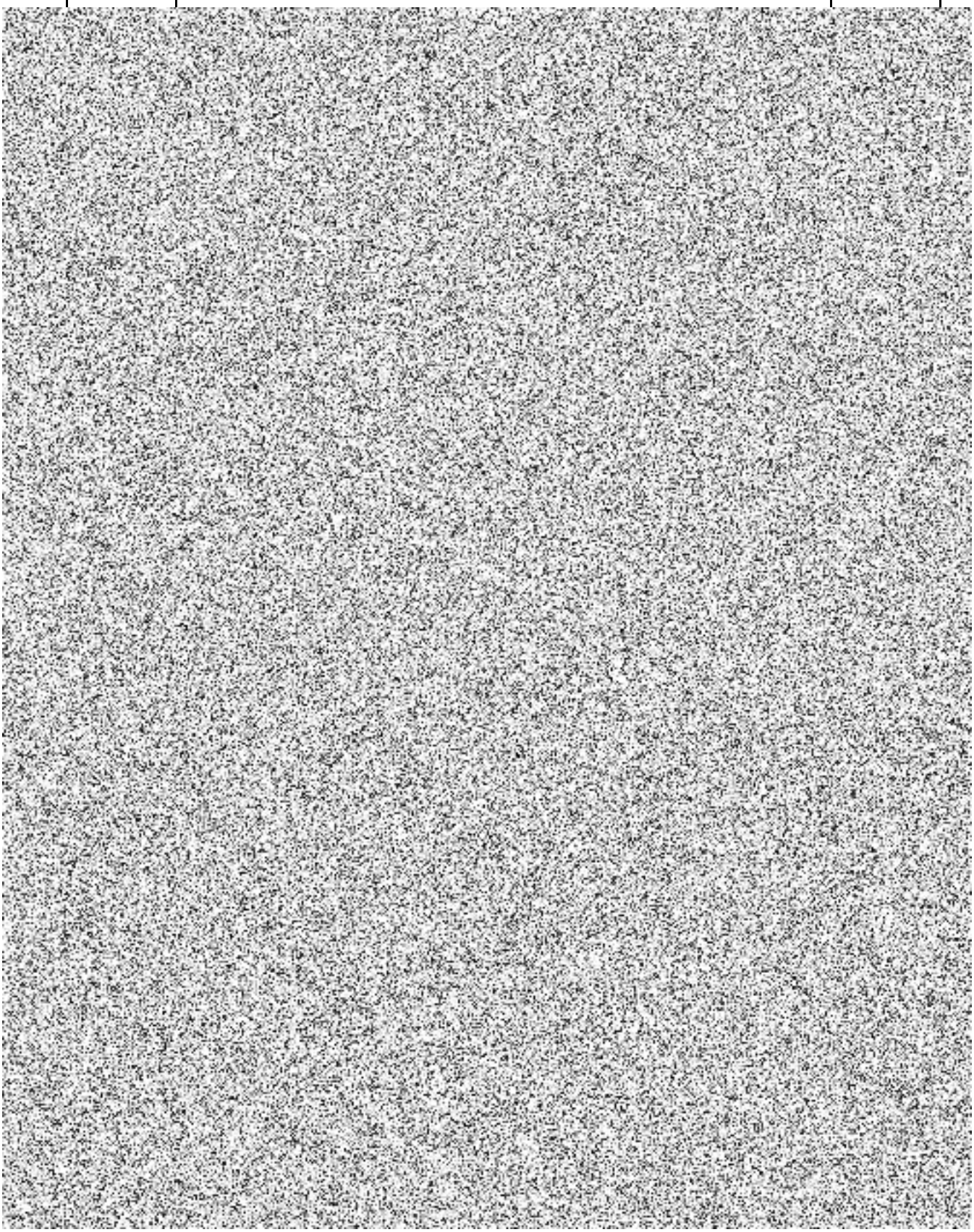


Figure N.4.1 Form of Order for Fuel Assemblies

NUCLEAR FUEL CONTRACT

APPENDIX O

DOCUMENT NAME:	NUCLEAR FUEL CONTRACT APPENDIX O

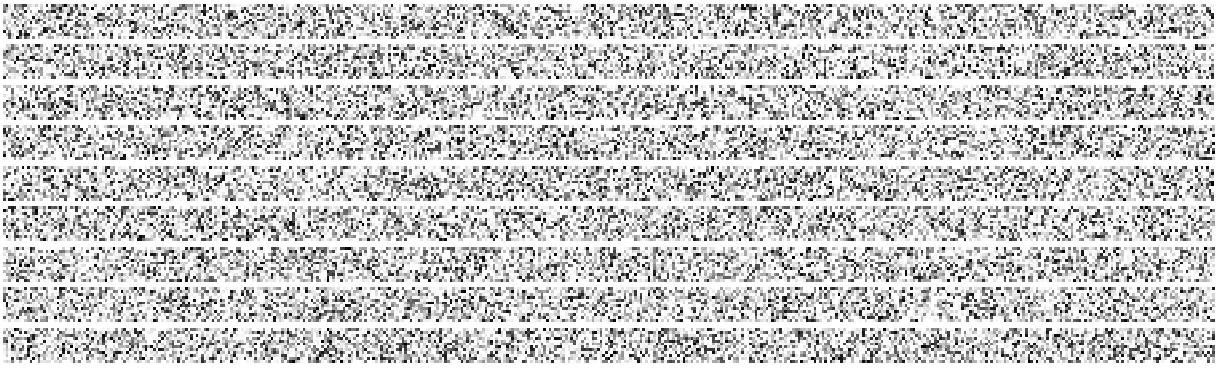
O - POST IRRADIATION INSPECTION PROGRAM AND REPAIR SERVICES

O.1 TESTING OF FUEL REPAIR AND INSPECTION EQUIPMENT (FRIE), AND RELATED INSPECTION AND REPAIR METHODS AND MEASUREMENTS

O.2 LIST OF PREDICTED / CALCULATED PARAMETERS OF FUEL ASSEMBLY AND CORE COMPONENT CHARACTERISTICS BASED ON PRECHARACTERIZED FUEL

O.3 DATA ACQUISITION DURING OPERATION AND OUTAGES

O.4 REPAIRS



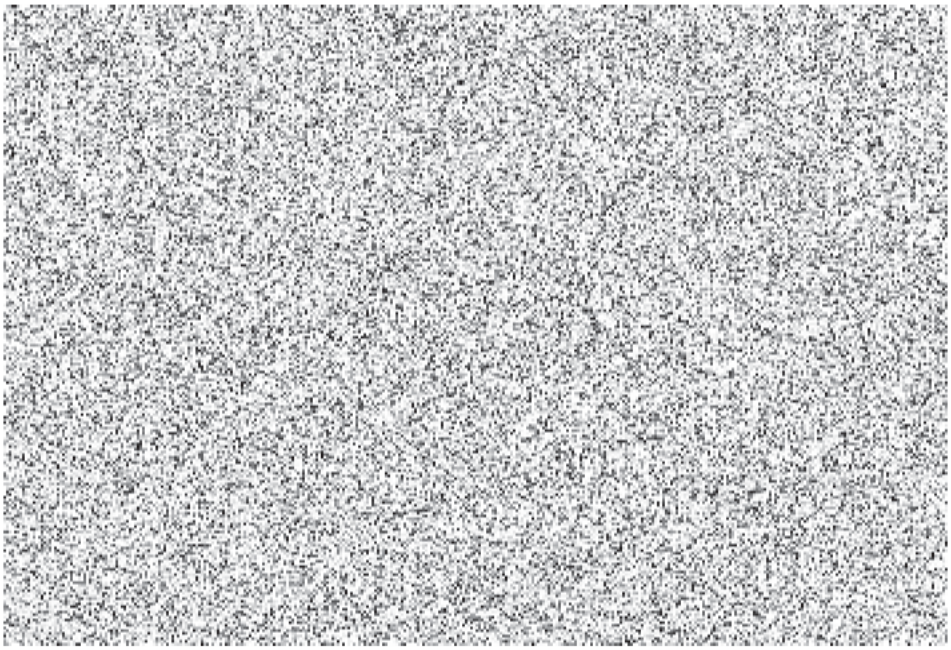


Figure O.1 Overview of repair Fuel

Table O.1 Repair service

The Supplier shall provide repair services as defined in Article 2.2.3.2. The repair services shall consist of damage detection, repair and root-cause evaluation.

a) leaking Fuel:

The leaking fuel rod identification, failed fuel rod replacement and leak cause determination scope shall consist of the following activities:

b) other damages

[redacted]

O.5 POST IRRADIATION INSPECTION PROGRAM (PIIP)

O.5.1 PIIP REQUIRED BY THE AUTHORITY AND THE OWNER

[redacted]

O.5.1.1 Inspection Target Fuel Assembly

[redacted]

Table O.2 Inspection target Fuel Assembly

[redacted]

O.5.1.2 Inspection List

Extent of PIIP shall include as a minimum:

[redacted]

[redacted]

O.5.2 MEASUREMENTS THAT CAN BE PERFORMED WITH A FULLY EQUIPPED FRIE

[redacted]

[redacted]

[redacted]

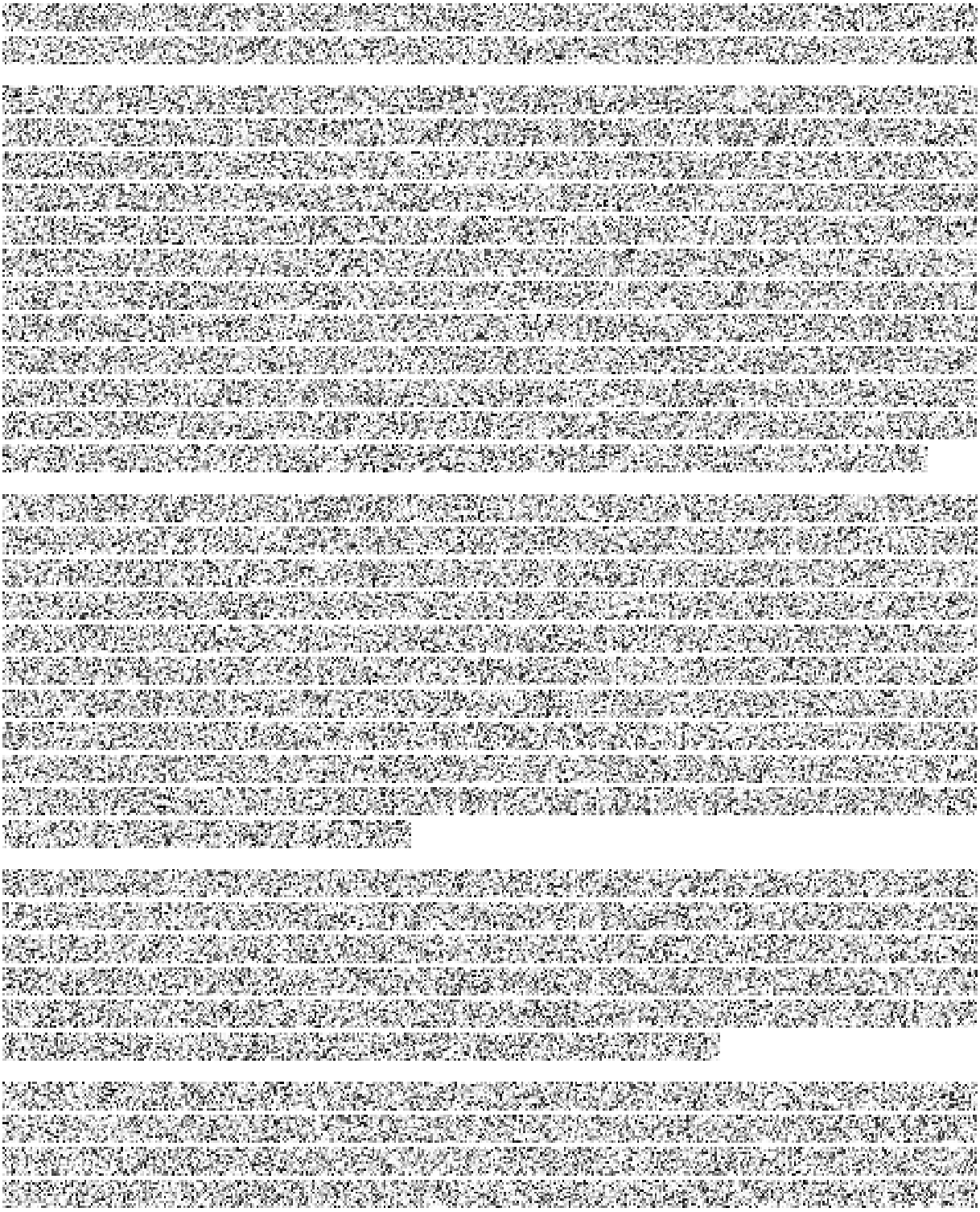
[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

O.6 METHODOLOGIES, PROCEDURES AND GUIDELINES FOR PIIP INSPECTIONS AND REPAIRS INCLUDING CRITERIA FOR EVALUATION OF FUEL ASSEMBLY AND CORE COMPONENTS CHARACTERISTICS

The Supplier shall perform PIIP and repairs as described in parts O.1, O.4 and O.5 in accordance with its methodologies, procedures and guidelines as specified in Appendix E.2.1 51).



O.7 EVALUATION OF PREDICTED TO MEASURED VALUES AND PIIP REPORT

After each PIIP campaign, Supplier shall evaluate PIIP data, compare PIIP data with the expected results defined in Parts O.2 and deliver a PIIP report to Owner.

O.8 PIIP AND FUEL REPAIR RELATED PROVISION OF MEANS OF FUEL MANAGEMENT

PIIP and fuel assembly repair related provision of the Means of Fuel Management shall be provided by Supplier to Owner as defined in Articles 2.2.4.7 and 2.2.4.9 h) and in Appendices H, I and J.

NUCLEAR FUEL CONTRACT

APPENDIX P

DOCUMENT NAME:	NUCLEAR FUEL CONTRACT APPENDIX P

P - IMPLEMENTATION PROGRAM

The Implementation Program is defined in Article 2.2.1 of the NFC and shall also include items specified below in Parts P.1 - P.4.

Implementation Program shall be divided into two phases, as specified in Appendix R, Part R.1.1 The individual stages of each phase of the Implementation Program (and respective milestones ending the individual stages) referred to in Part R.1.1 of Appendix R are specified in Tables P.1.1 and P.1.2 below.

Table P.1.1: Implementation Program stages related to the phase leading to application for license(s) for construction

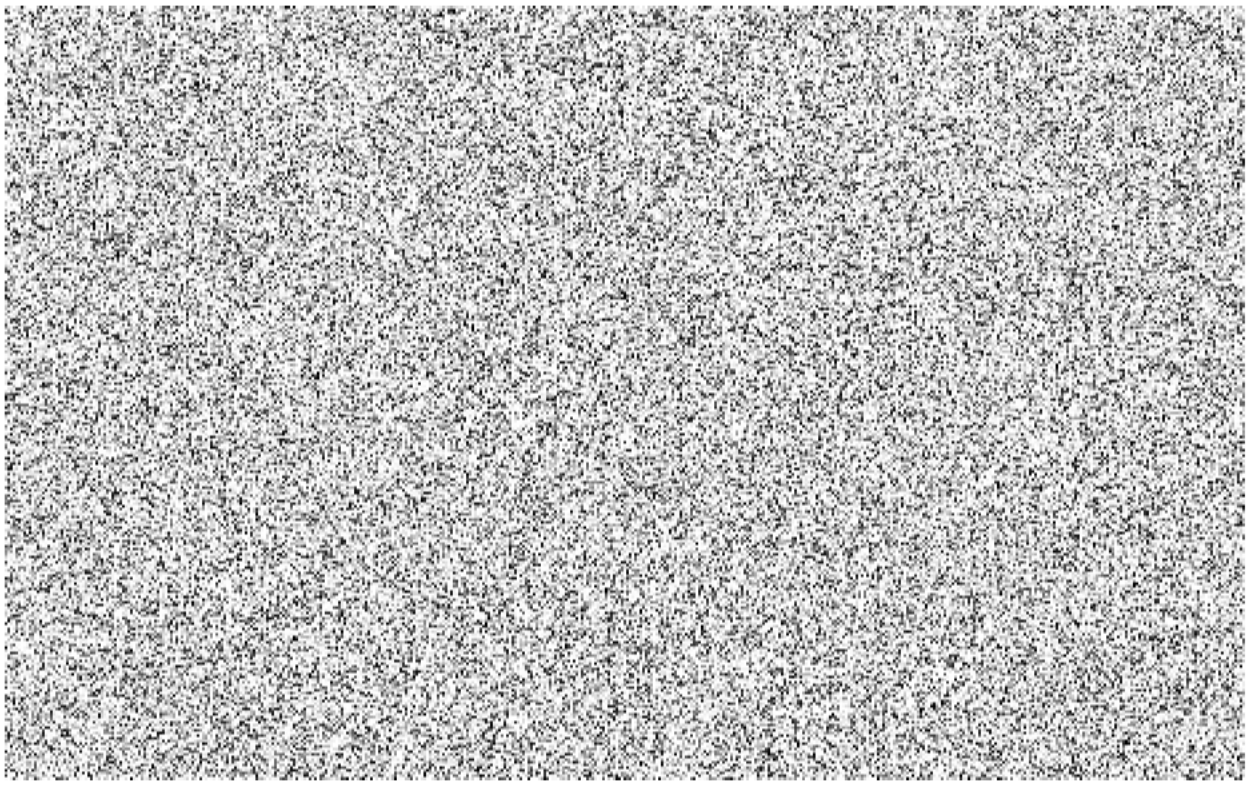
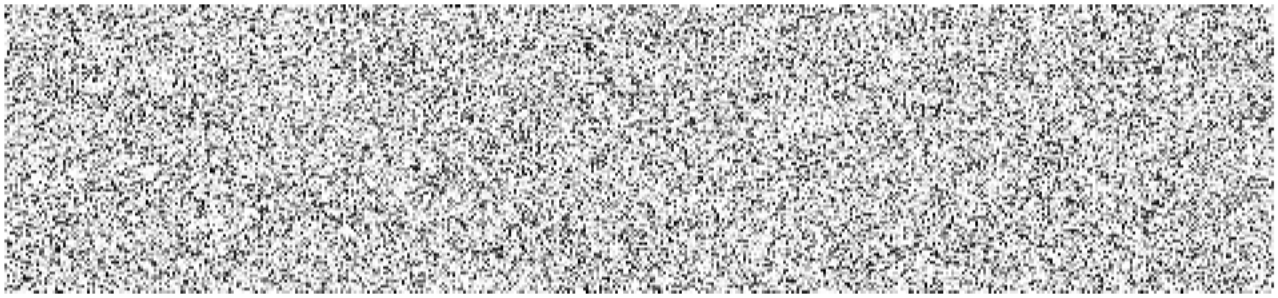
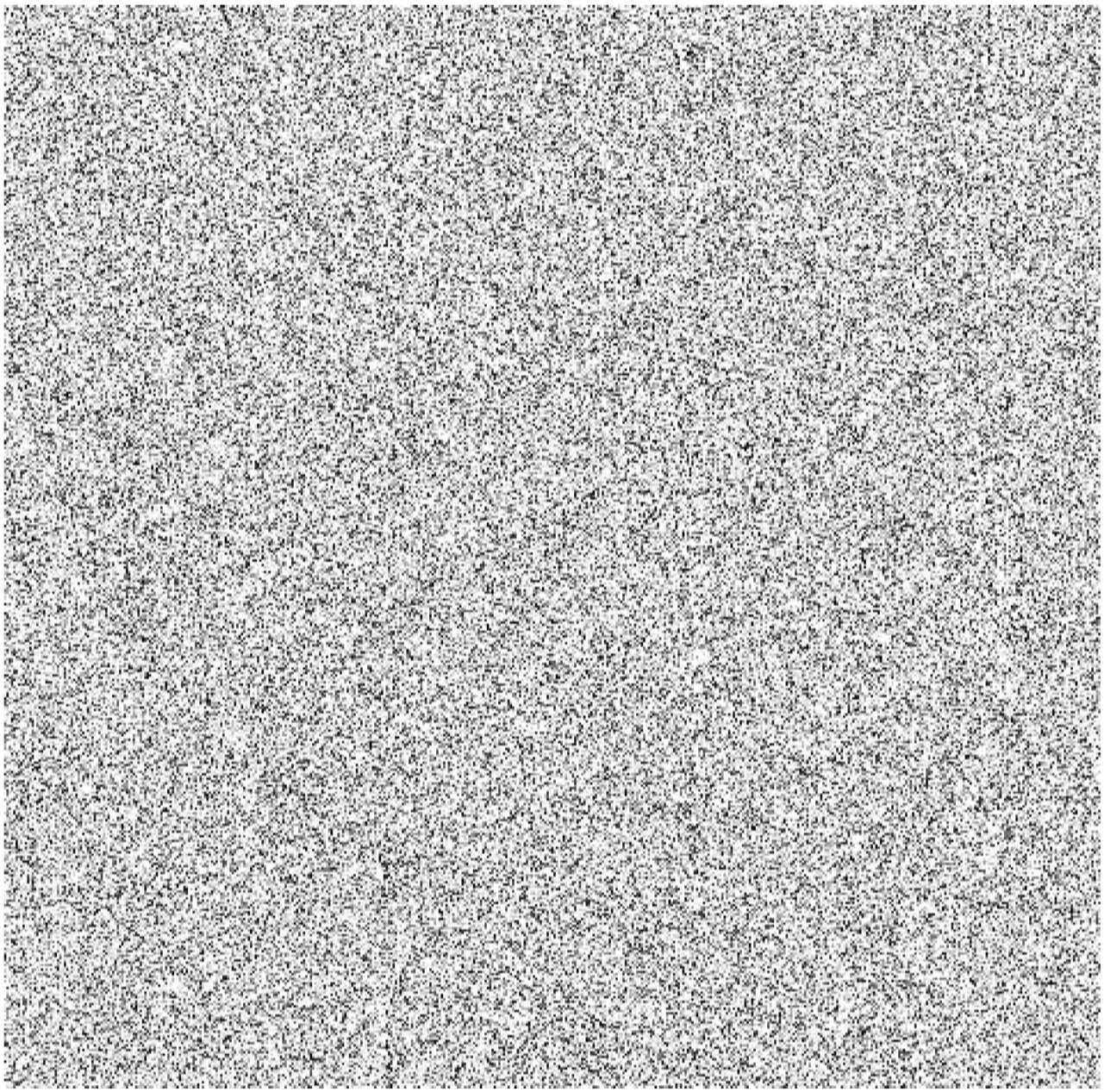


Table P.1.2: Implementation Program stages related to the phase leading to application for license(s) for operation





P.1 QUALITY MANAGEMENT PROGRAM

In accordance with Chapter 20 of the NFC, Supplier shall develop a Quality Management Program for the entire NFC Work.

P.1.1 INTRODUCTION

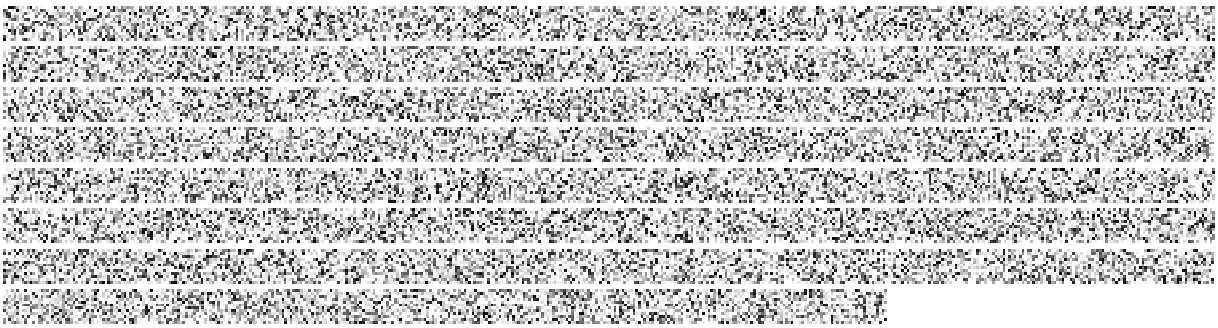
P.1.1.1 General Description

P.1.2 GENERAL REQUIREMENTS

PQM will comply with the requirements specified in EPC contract and NFC agreed between the Owner and KHNP.

P.1.3 QUALITY MANAGEMENT PROGRAM

P.1.3.1 Quality Management Policy



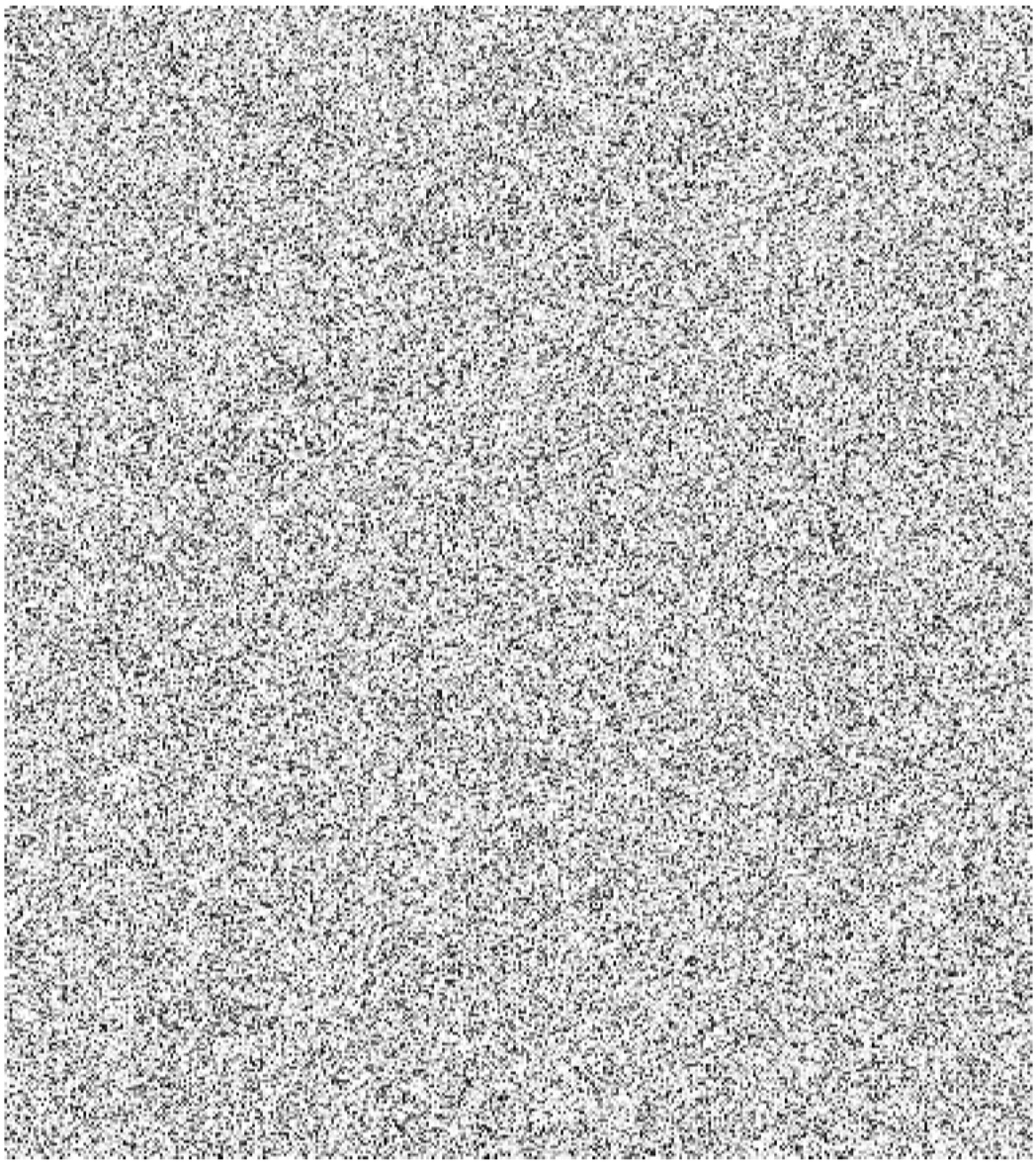


Figure P.1.1: KHNP's Quality Management System

P.1.3.2 Nuclear Safety Culture

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

P.1.3.3 Graded Approach

KHNP will apply the management requirements to the Project by using a graded approach with the following consideration;

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Table P.1.3 Graded Approach for KHNP

[redacted]

P.1.3.4 Quality Management Organization and Responsibility

[redacted]

Figure P.1.2 Project Organization for Quality Management In KHNP

[redacted]

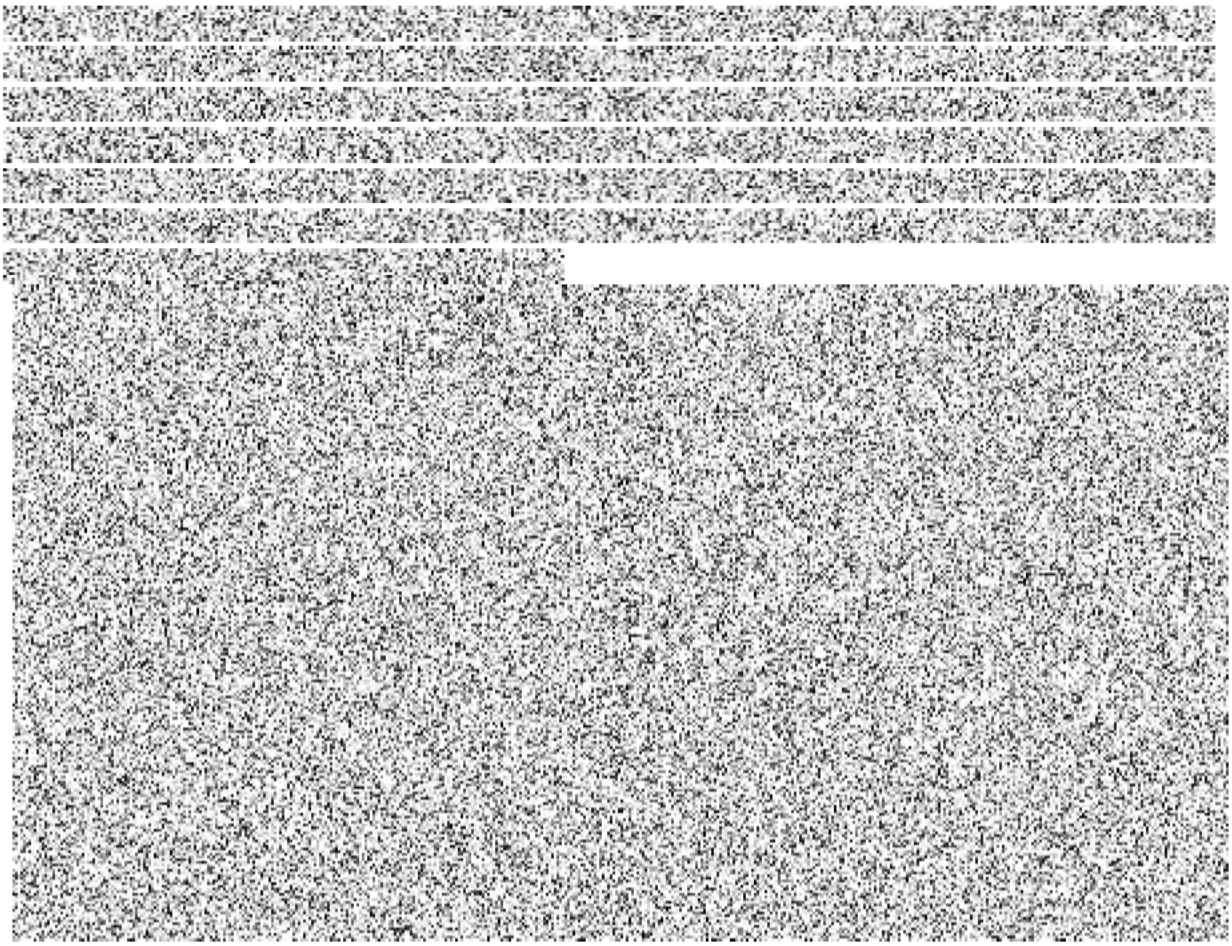


Figure P.1.3 Project Organization for Quality Management In Team-KHNP

P.1.4 DOCUMENTATION

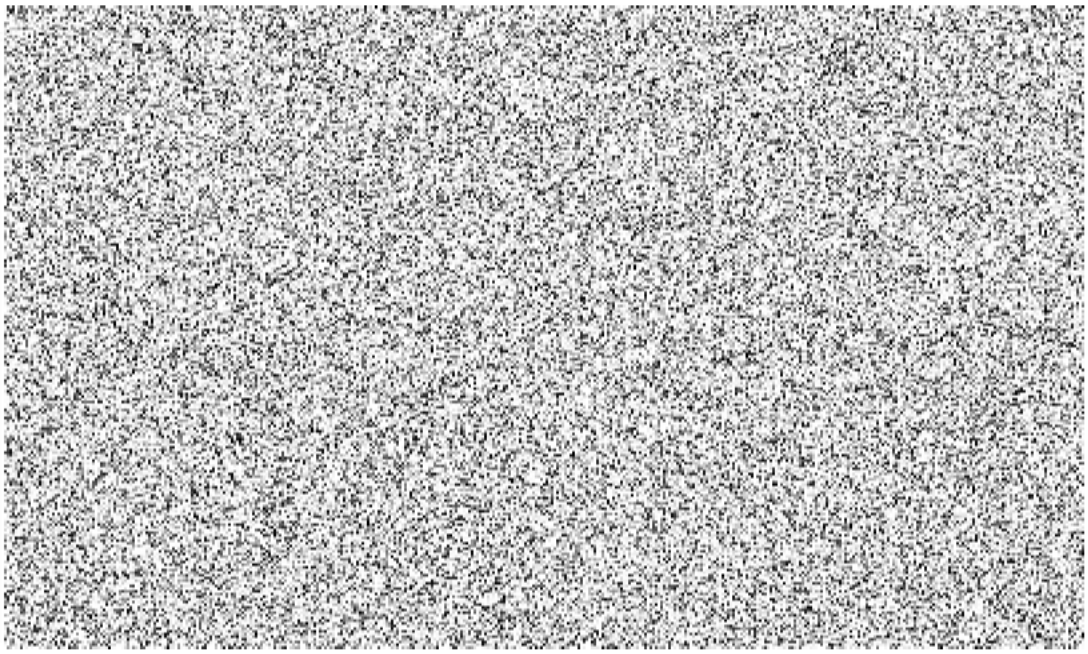
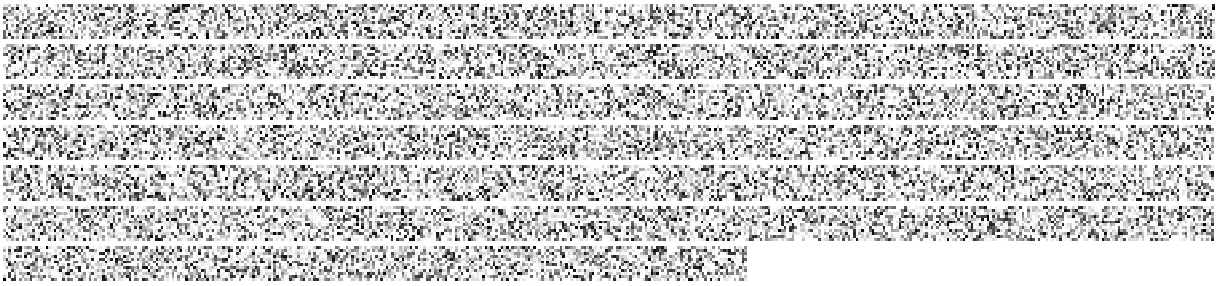


Figure P.1.4 Structure of Quality Documents

Process of Review the Quality Document

Quality Document Review



Control of Quality Document review results

P.1.5 QUALITY RECORDS AND REPORTS

P.1.5.1 Process of Records and Reports

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

P.1.5.2 Examples of Quality Records and Reports

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

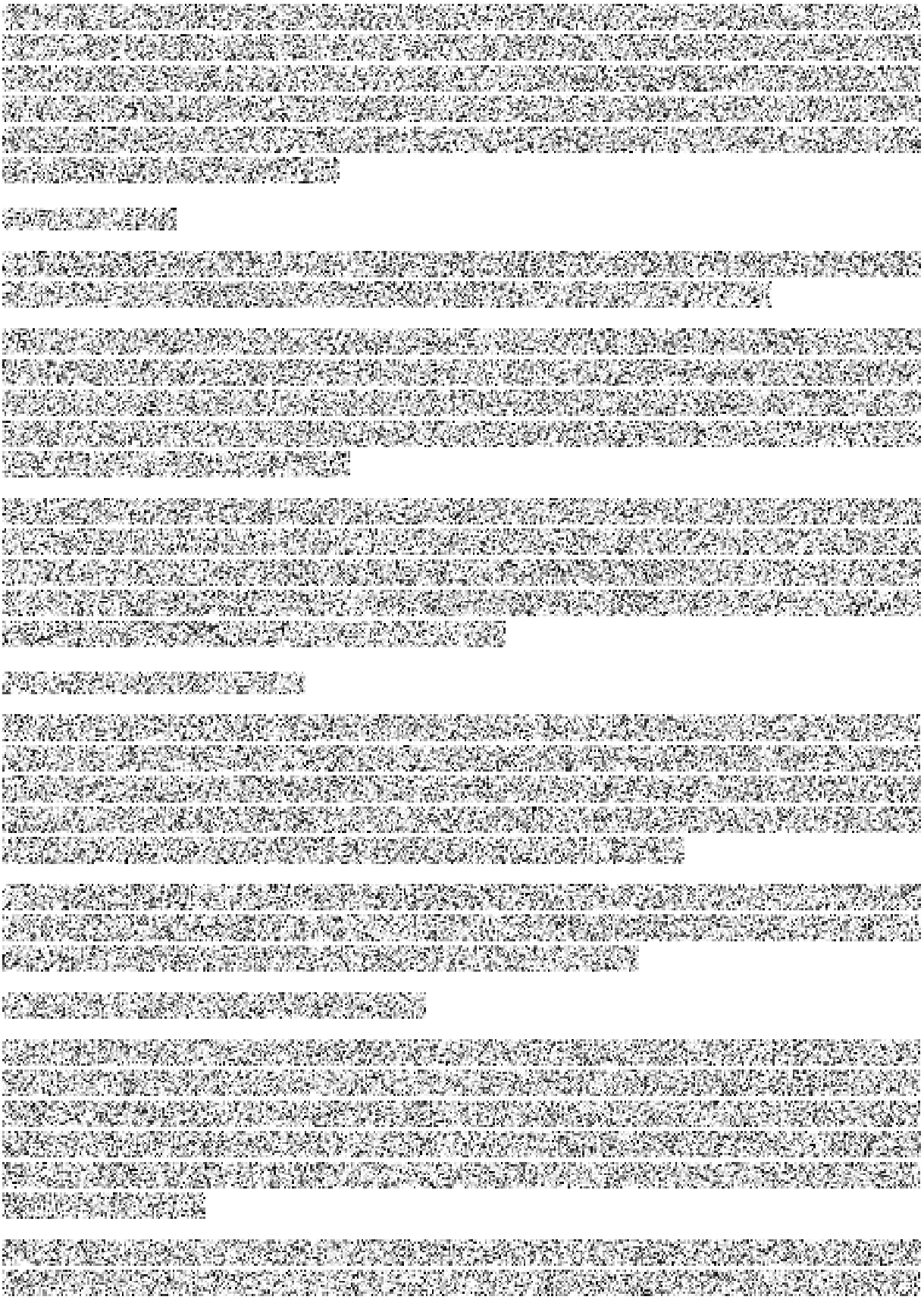
P.1.5.3 Evaluation of Effectiveness of Quality Management System

P.1.5.4 Trend Analysis for Non-conformances and Corrective Actions (NCR and CAR)

P.1.6 QUALITY VERIFICATION

P.1.6.1 Verification of Quality Management System

P.1.6.2 Verification of Products



P.1.6.3 Method of Detecting and Preventing Counterfeit, Fraudulent and Suspected Item (CFSI)

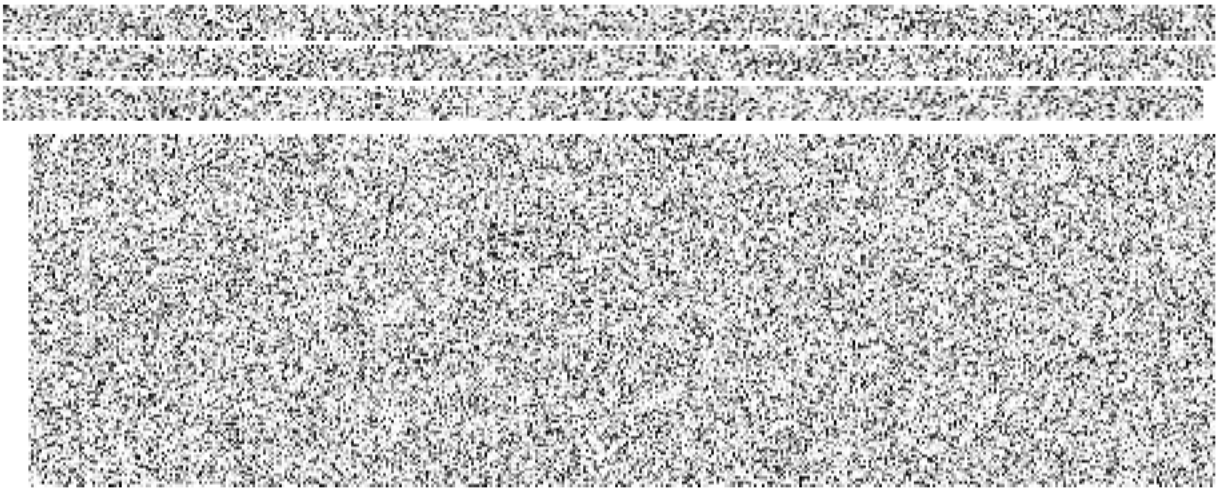


Figure P.1.5 Proposed CFSI verification scope

P.1.6.4 Control of Measuring and Test Equipment (M&TE)

P.1.6.5 Commercial Grade Dedication (CGD)

[redacted]

P.1.7 LESSONS LEARNED

[redacted]

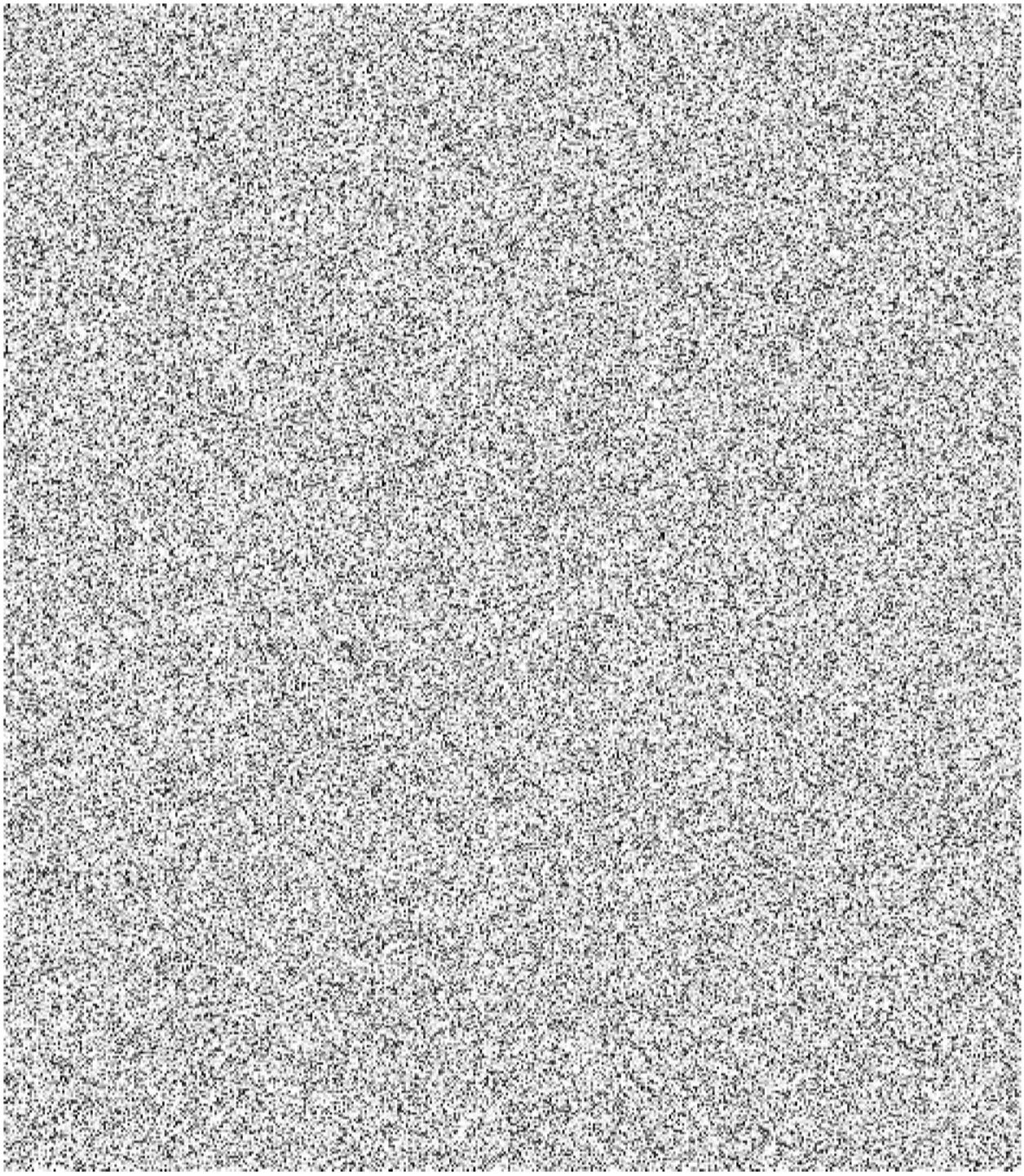
P.1.8 PROCEDURES

KHNP will develop procedures needed for the project implementation based on the QMS and submit them to the Owner prior to project commencement. The procedures may be revised by reflecting the Owner's comments.

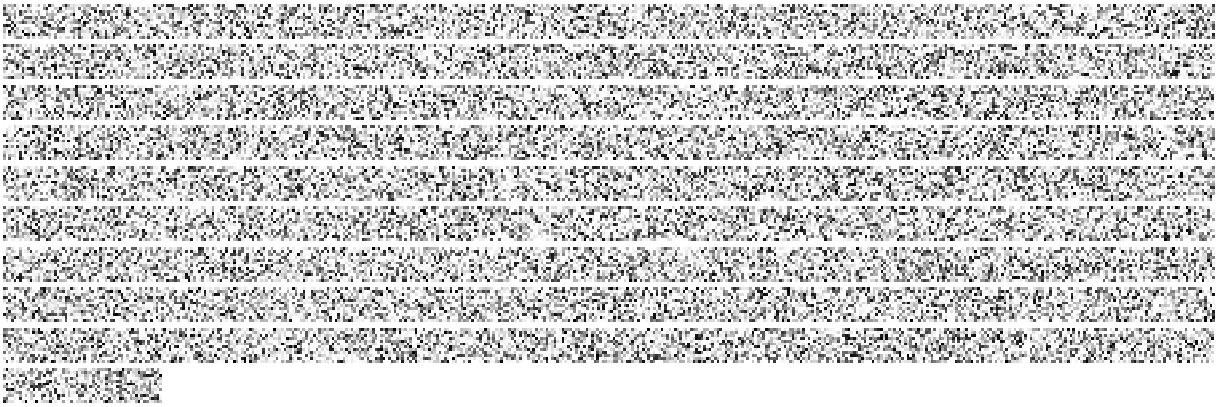
The procedures that KHNP have been using are shown as the Table P.1.4:

Table P.1.4 KHNP Procedure List for Oversea Business

[redacted]



P.1.9 REFERENCE PLANT



P.2 FUEL ROD, FUEL ASSEMBLY AND CORE COMPONENTS DESIGN

In accordance with Chapter 4 of the NFC, Appendix A and Appendix E, Supplier shall design the Fuel Rod, Fuel Assembly and Core Components for the Plant.

P.2.1 FUEL ASSEMBLY DESIGN

P.2.2 FUEL ROD DESIGN

P.2.3 CONTROL ELEMENT ASSEMBLY DESIGN

P.2.4 FUEL SYSTEM DESIGN WITH CORE PHYSICS DESIGN REQUIREMENTS

As stated in the above paragraphs, all sub-functions assuring the reactivity distribution, reactivity control, and compensation shall satisfy the requirements of Regulatory Authority.

P.2.5 THE PROCESS FOR ENSURING THAT THE PROPOSED DESIGNS SATISFY THE REQUIREMENTS

P.2.6 FUEL ASSEMBLY MECHANICAL CHARACTERISTICS

[redacted]

[redacted]

[redacted]

[redacted]

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[redacted]

[redacted]

[redacted]

P.2.7 CORE THERMAL AND HYDRAULIC CHARACTERISTICS

[redacted]

[redacted]

Thermal hydraulic design bases for core are set to prevent fuel damage by thermal or hydraulic factors during steady state and AOOs and to produce the guaranteed thermal power. The following design limits are set to satisfy the design criteria during steady state and AOOs.

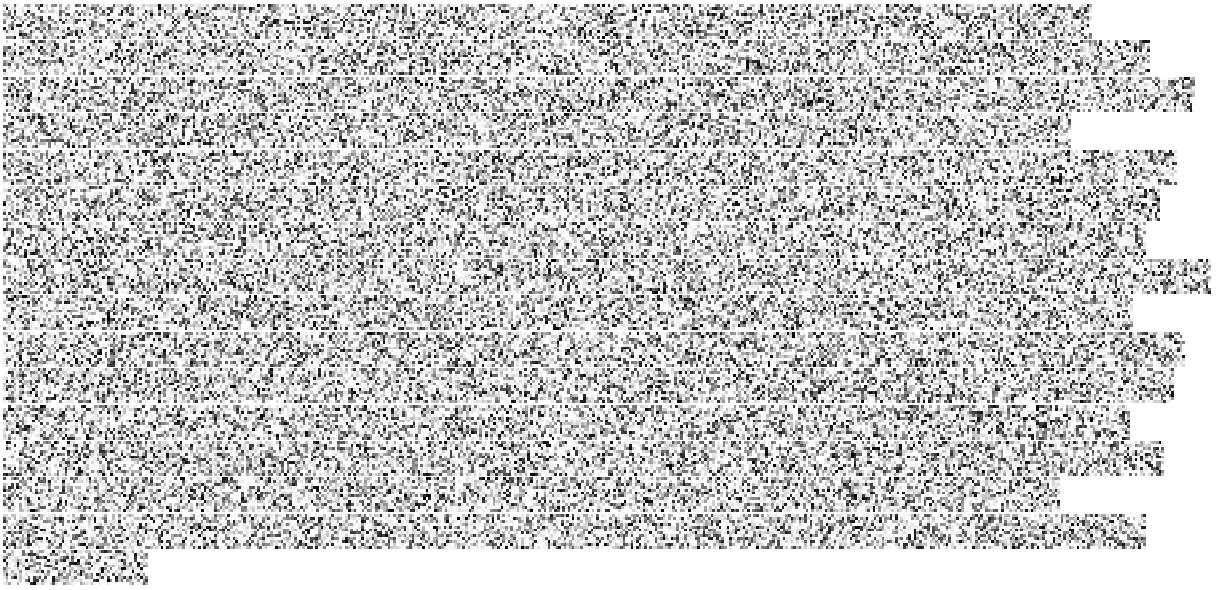
[redacted]

P.2.7.4 Chapter 4 of the SAR

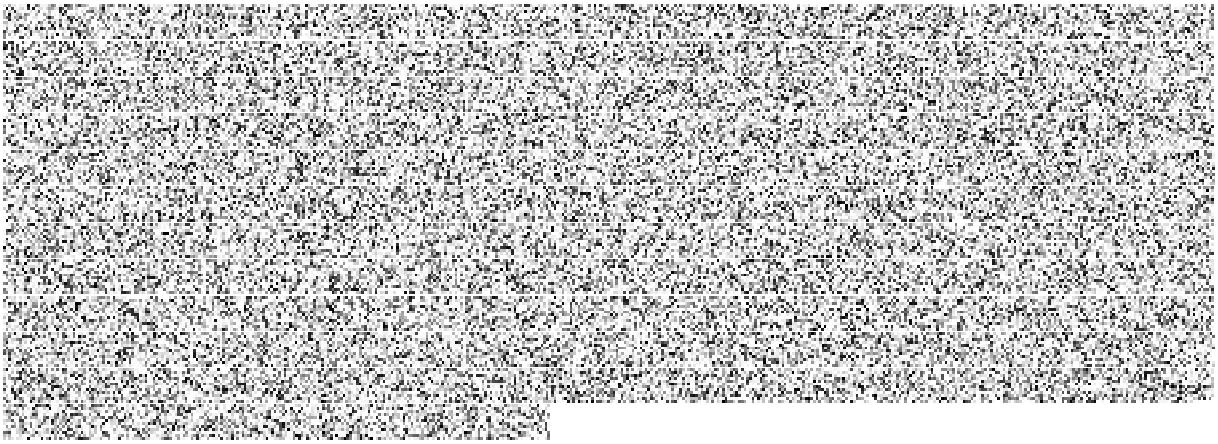
P.2.7.4.1 Fuel Rod Design (related to Chapter 4.2 of SAR)

[redacted]

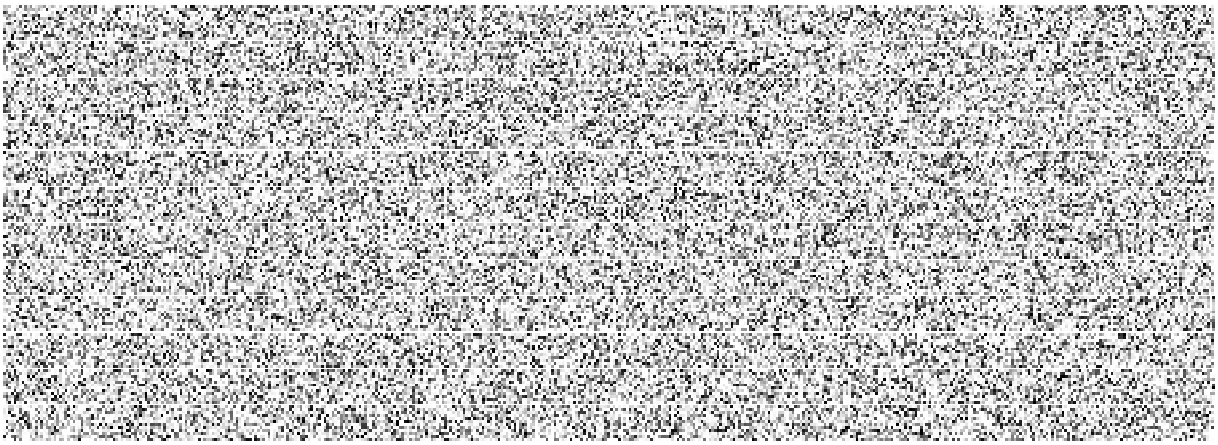
P.2.7.4.2 Mechanical Design (related to Chapter 4.2 of SAR)



P.2.7.4.3 Neutron-Physical design (related to Chapter 4.3 of SAR)



P.2.7.4.4 Thermal-Hydraulic design, including DNB tests (related to Chapter 4.4 of SAR)



[redacted]

P.2.8 INITIATING EVENTS IMPACTED BY A FUEL DESIGN (SAR CHAPTER 15 CASES)

[redacted]

[redacted]

15.1 Increase in heat removal by the secondary system

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

15.2. Decrease in heat removal by the secondary system

[redacted]

15.3 Decrease in reactor coolant system flow rate

15.4 Reactivity and power distribution anomalies (RIA)

[redacted]

15.5 Increase in reactor coolant inventory

[redacted]

15.6 Decrease in reactor coolant inventory

[redacted]

[redacted]

15.7 Postulated 15.7 events

[redacted]

15.8 Anticipated Transients Without Scram

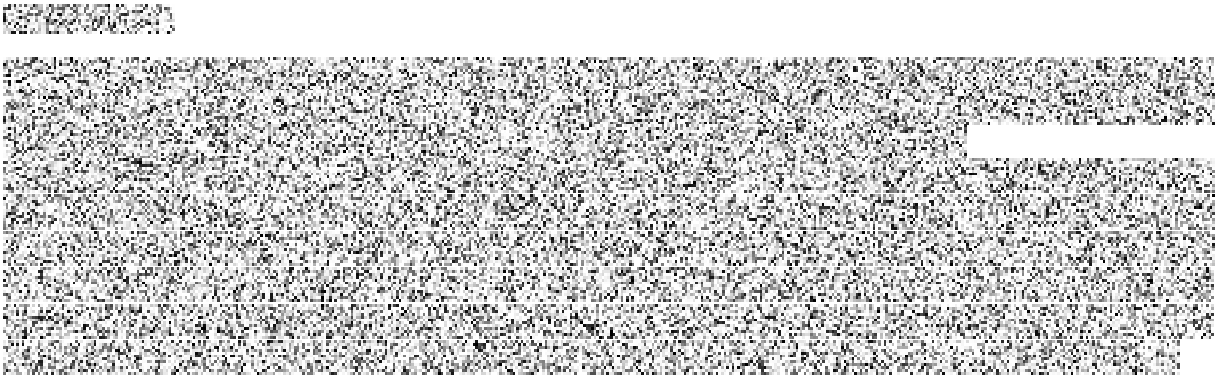


Table P.2.2 Initiating events impacted by a Fuel Design (SAR Chapter 15 cases)