

HANA NPE

HANA Nuclear Power Engineering Co., Ltd.

HANA Nuclear Power Engineering

**Proposal for Radiation Protection and
Radioactive Waste Treatment**

Total Management Solution For RP&RW

Radiation Protection

Radioactive Waste Disposal

Test & Calibration for RP

System Design

R&D

Agency Service Provider for RP In Private Sector

27 Years of Experience

20+ Completed Projects

600+ Employees

USD250M+ Contract Value



Manpower



Senior Engineer

60+ people
20 years+ experience

- Reactor Senior Operator for Nuclear Power Plant
- License holder of Senior Operation Advisor for Nuclear Power Plant
- License holder of Professional Engineer Radiation Management
- License holder of the Supervisor of Radiation Handling
- Senior Radiation Protection
- Radwaste Management
- Representative Management for related Radiation
- Researcher for R&D
- Application of Design Work



Engineer

120+ people
10 years+ experience

- Reactor Operator for Nuclear Power Plant
- License holder of General License for Radioisotope Handling
- Radiation Protection
- Test Facility for Radiation/Radioactivity
- Calibration Facility for Radiation/Radioactivity
- Radioactivity Analysis
- Design for Liquid Waste Management System
- Design for Gaseous Waste Management System



Senior Technician

160+ people
10 years+ experience

- RP service for Replacement of Reactor Vessel Head
- Perform field work by Station



Technician

240+ people
Graduate of a related college

- Radiation Protection
- Radwaste Management
- RP service for Replacement of Reactor Vessel Head
- Test Facility for Radiation/Radioactivity
- Calibration Facility for Radiation/Radioactivity



HANA NPE



Main Business Lines

Radiation Protection Support Service for Nuclear Facilities

- Radiation Safety Management of NPP
- Treatment of Radioactive Wastes
- Health Physics for Workers' Radiation Safety
- Other radiation-related activities

Radiation Safety-Related Engineering Service

- PSR (Periodic Safety Review) for NPP
- Environmental Impact Assessment for NPP
- Developing Emergency Preparedness Plan for NPP
- Developing education program for radiation safety

Radioactive Waste Management Service

- Free-Release of radioactive wastes after decontamination (concrete, metal scrape, etc.)
- Treatment of Radioactive materials
- Clearance for Radioactive Waste

R&D Activities Related to Radiation Safety

- Research Institute was established in 2003 and a number of remarkable performances has been made:
(Developed passive type Hydrogen Recombiner for NPP, etc.)
- Actively involved in the cooperative research project with government labs, universities, etc.
(Decontamination of replaced large equipment such as S/G, Reactor Head, etc.)

System Design for Nuclear Facilities

- Liquid Radwaste Management System Design and Manufacture
- Gaseous Radwaste Management System Design and Manufacture
- PVA Processing Unit Design and Manufacture
- Flow layer CO₂ Removal Device Design, etc.

Environmental Radioactivity Analysis

- Food and livestock products radioactivity testing
- Survey and Analysis on Naturally occurring radioactive materials in soil
- Analysis of Sample for leak test for sealed radiation sources
- Environmental Radiation measurement and analysis around the nuclear facilities

NSSC-approved Agency Service Provider of RP for Private Sector

- Removal of Radioactive Contamination
- Collection, treatment, and transportation of radioactive isotopes and radioactive waste
- Preparation of radiation safety report and safety management regulations
- Supervision (Inspection) of Installation of facilities, etc.
- Radiation Safety Management

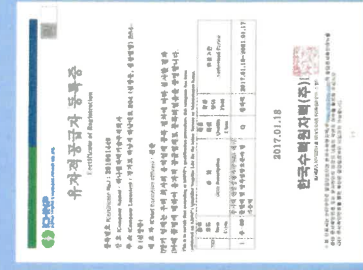
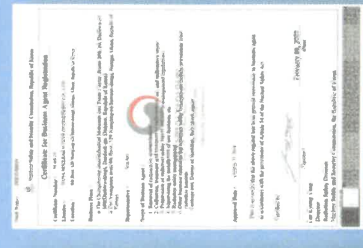
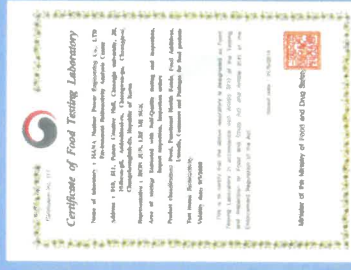
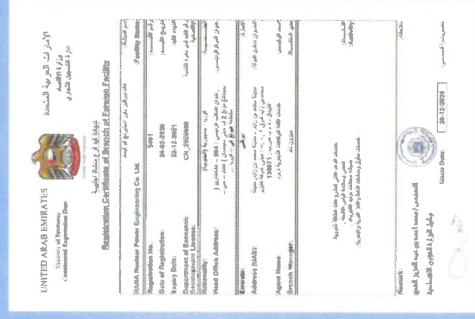
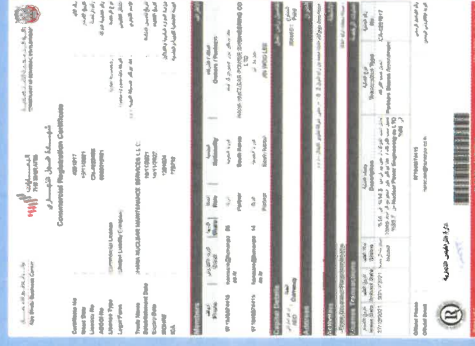
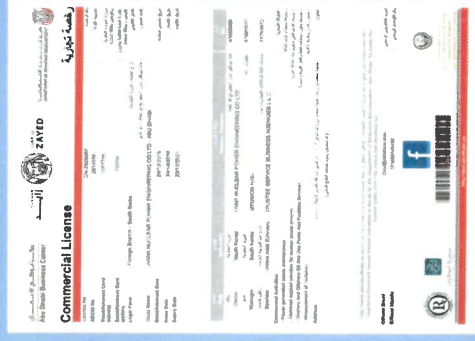
Decommissioning Business of NPP

- Participation in government-sponsored R&D projects
- Registered supplier of Decommissioning Technology in KHNP's Supply chain

Sale Agent for RP product

- ETI(OREX)

Certification



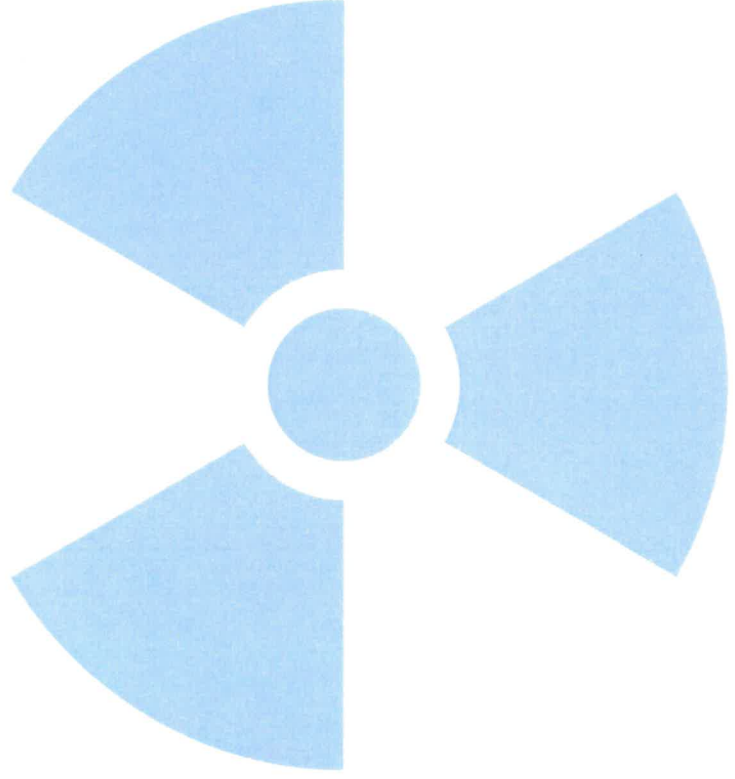


Clients and Business Partners

 مؤسسة الإمارات للطاقة النووية Emirates Nuclear Energy Corporation	 KEPCO	 KHNP	 ENP Korea	 한솔에너지주식회사 Hansol Energy Company	 KEPCO NF
 DOOSAN	 Korea Atomic Research Institute KAERI	 Better Standards, Better Life! KRIS 한국표준과학연구원 Korea Research Institute of Standards and Technology	 IAE Institute for Advanced Engineering	 EN+	 TAEKWANG
 청주대학교 CHEONGJU UNIVERSITY	 KIRAMS	 HANKUK UNIVERSITY OF SCIENCE AND TECHNOLOGY HUST	 SAMSUNG ENGINEERING	 Korea Ministry of Food and Drug Safety	 KYONGGI UNIVERSITY
 HYUNDAI ENGINEERING CO., LTD.	 Ministry of Environment	 Ministry of Land, Infrastructure and Transport	 IDL Construction	 ETI THINK MAKE PROTECT Eastern Technologies, Inc.	 한국원자력환경공단 KORAD



Radiation Protection Service for KHNP and UAE



2022	10	Awarded for Wolsung NPP Unit 1,2(Candu type) for RP
	06	Awarded for ShinHanUI NPP Unit 1,2 (APR 1400) for RP
2021	11	Registered Commercial License of HANA Nuclear Maintenance Services L.L.C. in UAE
2020	07	Awarded for BNPP UAE Unit 1,2,3,4 for RP
	02	Registered Branch of Foreign Facility in Abu Dhabi, UAE
2019	12	Registered Commercial License in Abu Dhabi, UAE
	10	Ministerial Commendation of Ministry of Trade, Industry and Energy
	08	Awarded for HanUI NPP Unit 1,2 for RP
	07	From KOLAS certified for Environmental radioactivity test on food/soil/water quality
	06	Awarded for KoRI NPP Unit 3,4 for RP
	04	Awarded for HanUI NPP Unit 5,6 for RP
2017	04	Awarded for ShinHanUI NPP Unit 1,2 (APR 1400) for RP
		Awarded for KORAD (Korea Radioactive Waste Agency) for RP
	03	Registered as a testing agency in the field of Radiation by the MFDS
2016	11	Registered Supplier of ENEC (Nawar) (Supplier Number : 7163)
	05	Awarded for Outage radiation management for all NPPs in Korea
		Awarded for Wolsung NPP Unit 1,2 for RP
2015	11	Obtained certification for ISO 9001; 2015
	09	Awarded for KoRI NPP Unit 3,4 for RP
2014	10	Ministerial Commendation of Ministry of Science and ICT
	08	Awarded for shin-Wolsung NPP Unit 1,2 for RP
	06	Spin off from HANA I&E Co., Ltd. To HANA Nuclear Power Engineering Co., Ltd.
2013	02	Awarded for Outage radiation management for all NPPs in Korea
		Awarded for KoRI NPP Unit 1,2 for RP
2009	10	Awarded for ULJIN NPP Unit 1,2 for RP
2004	02	Awarded for KoRI NPP Unit 1,2,3,4 for RP
2003	08	Registered in radiation management service business of KHNP
	07	Recognition of Company research institute
1999	06	Approval of Radiation Management Company of Nuclear Power Plant to KENCA
1996	05	Foundation of HANA I&E Co., Ltd.



Scope of Work for RP & RW

RCA access and work control

- RCA access control (access control, contamination monitoring)
- Radiation exposure management
- RCA work control
- Perform workplace monitoring before/during/after radiation work and Job coverage
- Gaseous and Liquid effluent release permit
- Support Health Physics facilities and equipment management
- Respond to abnormal radiological conditions

Radiation and Radioactivity survey and RMS operation

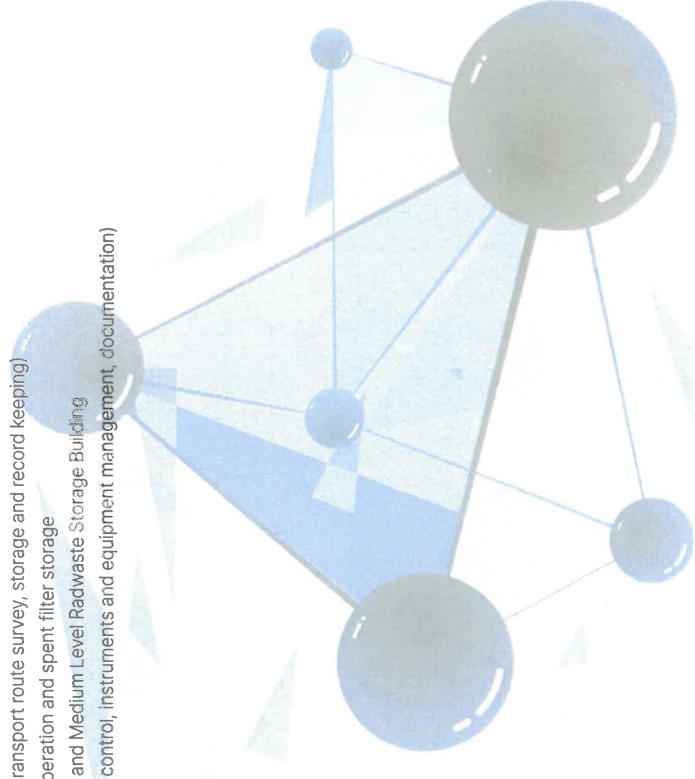
- Radiation Monitoring System Operation
- Radiation and Radioactivity survey of Protected Area
- Support counting room operation
 - Gamma Spectroscopy, LSC and Low BKG Alpha-Beta Counter operation
 - Sampling and analysis

Area Decontamination, and PPE Laundry

- Area decontamination of RCA
- Contain contaminated liquid leaks in the RCA to minimize contaminated areas
- Respirators Management

Radioactive Waste Treatment

- Radioactive Waste Management according to waste minimization plan and operation of RW equipment
- Treatment (segregation, sampling, analysis and storage/disposal) of RCA HVAC filter train for waste minimization
- Treatment (sampling analysis, drying, storage/disposal) of secondary side resin, filter
- Sampling, sample storage and record keeping for waste characterization
- Support to dispose of Clearance Level Waste,
 - Bag Monitor operation
 - Documentation and transport to general waste storage area.
 - Clearing items from RCA
- Transport and storage of radioactive waste in Low and Medium Level Radwaste Interim Building including waste drum
 - (survey, posting, transport and transport route survey, storage and record keeping)
- Spent Filter handling machine operation and spent filter storage
- Support Nawah to manage Low and Medium Level Radwaste Storage Building
 - (routine survey, drum inventory control, instruments and equipment management, documentation)





RP for Replacement of Major Equipments



1 Jun 2010 to 17 Oct 2013

Radiation Protection for Replacement
of Reactor Vessel Head of KoRi Unit 1



18 Aug 2016 to 31 Jul 2018

Radiation Protection for Replacement
of Reactor Vessel Head of KoRi Unit 2



25 Apr 2013 to 31 Dec 2015

Radiation Protection for Replacement
of Reactor Vessel Head of YoungKwang Unit 3&4



4 Sep 2018 – continued

Radiation Protection for Replacement
of Reactor Vessel Head of HanUl Unit 1&2



4 Sep 2011 to 26 Nov 2011

Radiation Protection for Replacement
of Reactor Vessel Head of KoRi Unit 1



3 Mar 2012 to 17 May 2012

Radiation Protection for Replacement
of Reactor Vessel Head of KoRi Unit 1



17 Dec 2012 to 28 Feb 2014

Radiation Protection for Replacement
of Steam Generator of UIChin(HanUl) Unit 3&4



7 Aug 2019 to 31 Jul 2021

Radiation Protection for Replacement
of Steam Generator of UIChin(HanUl) Unit 5&6

Capabilities and Experiences



Introduction of PVA processing technology

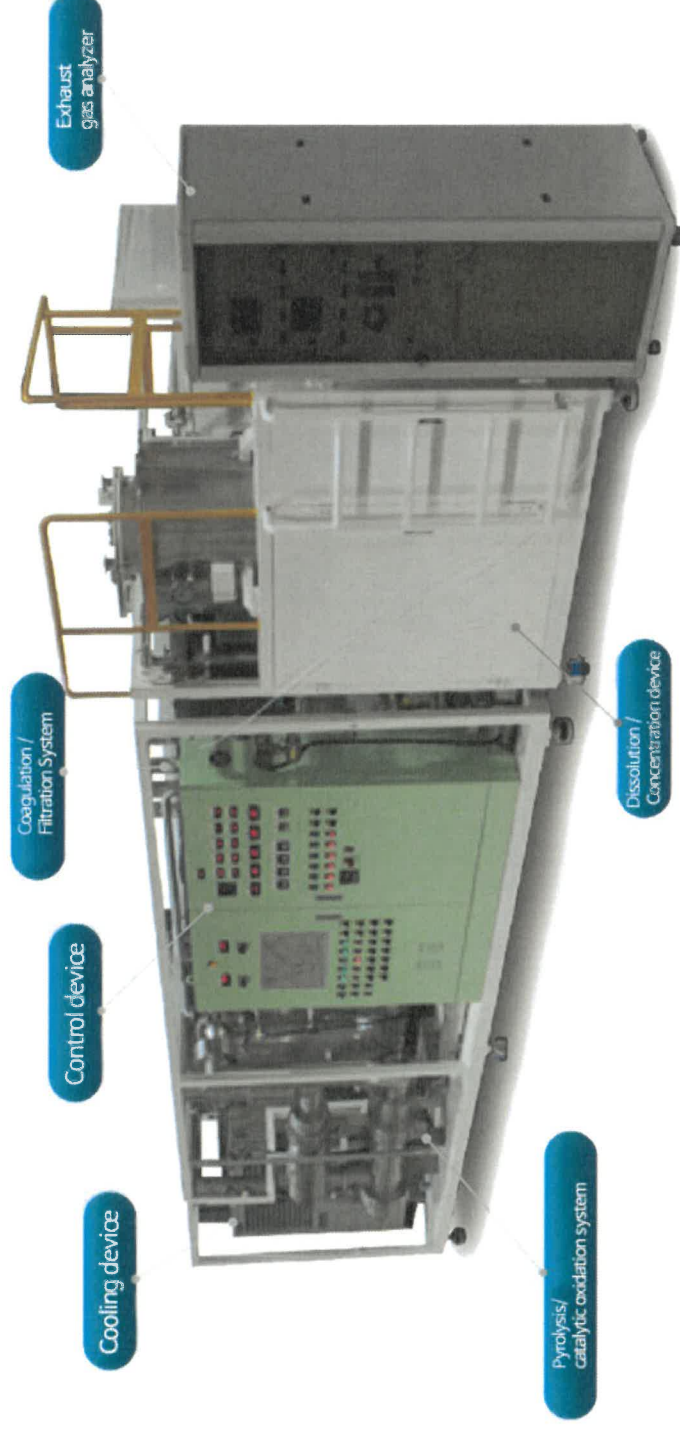
Introduction

- PVA has a characteristic of dissolving in high temperature water through special treatment technology
- Easy to remove particulate pollutants on surface when PVA protection products dissolve
- Waste pollutant separation can be completely treated with H₂O and CO₂ using pyrolysis/catalytic oxidation technology

Records

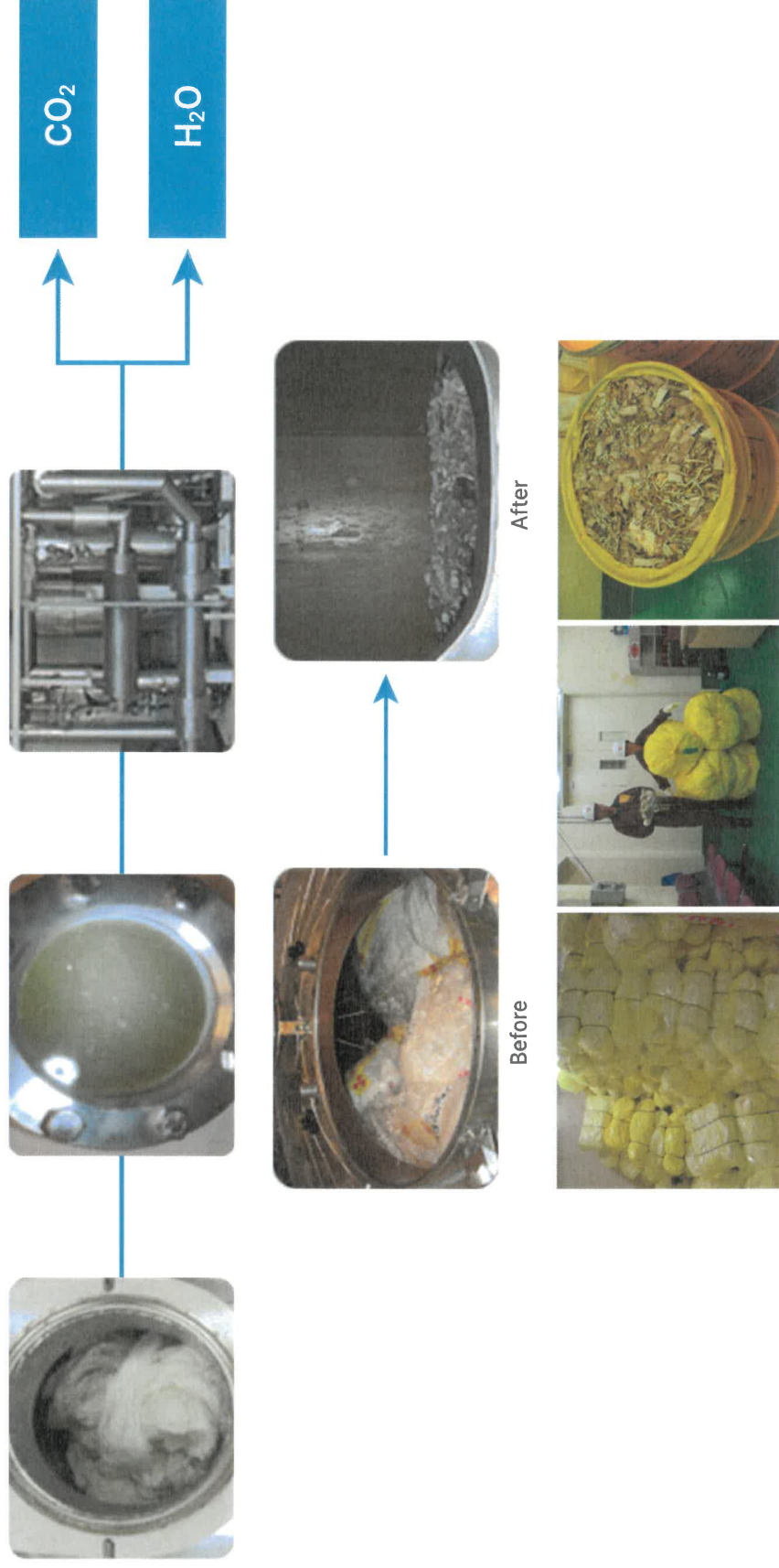
- Won the bronze prize at the Korea Technology Award in 2010
- 2 patents and 2 papers related to processing technology

Device appearance



Process

- Process all parts except very little insoluble material(ex : zipper)
- Possibility to reduce waste through pyrolysis/oxidation treatment (reduction ratio: more than 1/100)
- Reduce waste disposal costs
- Eco-friendly processing technology (processed below environmental regulations)



Capabilities and Experiences



Analysis Center

Environment Radioactivity Analysis

2016

Feb

Establishment of Environmental Radioactivity Analysis Center

2017

Mar

Designated as food and livestock products testing & inspection laboratory radioactivity by MFDS

May

(MFDS : Ministry of Food and Drug Safety)

Radioactivity analysis & inspection service for food [Guro-gu Office]

June

Conduct consentment service for radioactive safety management in food (MFDS)

2019

Jul

Accredited by KOLAS (International Authorized Testing Agency) in the field of radioactive substances test

Nov

Conducted detailed survey of the distribution of naturally occurring radioactive materials in the soil

Dec

Conduct indoor radon concentration and radioactivity analysis in the soil and rock [National Institute Of Environmental Research]

2020

May

KOLAS regular assessment

Jul

Conducted detailed survey of the distribution of naturally occurring radioactive materials in the soil [National Institute Of Environmental Research (2020)]

Oct

Approval of establishment of Korea Radioanalytical Association (Board)

2021

Mar

Conduct a characterization survey of distribution of natural radioactive materials in the Chungnam ar [Chonnam National University]

2022

Jan

KOLAS Regular assessment



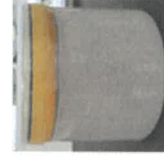
Food and livestock products radioactivity inspection (Ministry of Food and Drug Safety)

Radioactivity test and import inspection for food, livestock products and food additives distributed in Korea



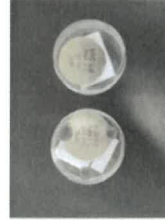
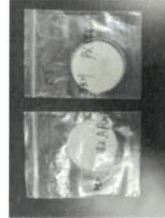
Survey on Naturally Occurring Radioactive Materials in Soil (National Institute Of Environmental Research)

Analysis of Naturally Occurring Radioactive Materials in Soil
- Gamma-emitting nuclides analysis of soil and rock sample
- Analysis of ^{226}Ra , ^{232}Th , ^{40}K
- Standardization of analysis procedures



Analysis of Sample for leak test for sealed radiation sources

Analysis of samples taken for leak test at the facilities using radioactive isotopes



Environmental Radiation measurement and analysis around the nuclear facilities in Daejeon (Daejeon city-hall)

Environmental radiation investigation
around nuclear facilities Spatial Gamma-Ray Energy
Spectrum Measurement Radioactivity analysis
of Environmental samples



Capabilities and Experiences



R&D

23 Apr 2021 to 20 Jan 2022	Decontamination and transportation of replaced Heating Ventilating and Air Conditioning (HVAC) during the improvement work of HVAC of KoRi Units 3&4 It is the task of decontaminating discarded AHUs to meet the relevant standards and taking them out to the general area. In order to recycle the taken-out metal, it should be developed based on GASPAR and K-DOSE Code in use at nuclear power plants should be applied to guide it to 1/2 of the dose of mass exposure to the general population and then disposed for recycling.	24 Feb 2021 to 30 Jul 2021, TAEKWANG	Processing and analysis of samples for Clearance of uranium contaminated waste from petrochemical plants Soil waste contaminated with uranium used as a catalyst in petrochemical plants is classified through the Survey and Surface Contamination Measurement. The wastes classified in this way are evaluated using MCNP Code and REARAD Code, and the radioactive concentration of uranium that satisfies 1/2 or 1/10 of the dose limit of the mass exposure to the general population is calculated and decontaminated below the standard level. In addition, if this waste fits the clearance level, it is a job to obtain a license and dispose of it.	07 Sep 2020 to 17 Jan 2021	Hanbit Unit 6 Nuclear Power Plant Replace of Steam Generator Radiation Protection Service This work is carried out during the Nuclear Power Plant Outage period, and radiation management is carried out for the replacement of the steam generator because it cannot perform properly due to the U-tube pipe blocking work. In addition, this work is to conduct radiation protection to prevent excessive radiation exposure in high radiation and other radiation control areas, and to classify and manage radioactive waste generated during replacement work.	31 Jul 2020 to 31 Dec 2020 / 21 Nov 2019 to 15 Nov 2020	A Detailed Survey on the Soil Distribution of Natural Radioactive Materials This task is to investigate the radioactive distribution of natural radionuclides in the soil of the Hangang River basin. Radioactivity analysis is to analyze natural radionuclides in soil using HPGe Gamma nuclide analysis equipment for samples that have completed radiation equilibrium in a measuring container by drying, homogenizing, and sealing soil samples around the river boundary.
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01 Jan 2010 to 31 Dec 2011	Liquid sample analysis service to verify the effectiveness of system operation to reduce C-14 This is to verify the effectiveness of the operation to reduce C-14, and the liquids of the RCS and SFP systems are sampled. Among these samples, C-14 is separated and packaged in chemical and physical forms, pre-treated using a catalyst facility, and analyzed by LSC.	12 Jul 2018 to 10. Nov 2018	Practical application of Decommissioning Process Simulation – Contamination Measurement and Evaluation The task is to measure and evaluate the internal radioactivity of Kori Unit 1, which is scheduled to be after permanent shutdown. Radionuclide and radioactivity are measured using the radiation dose rate data of the space at the main measuring point of the reactor building and auxiliary building decommissioning of Kori 1 and the LaBr3 detector. The 3D simulation is implemented by reflecting the results of the inside of Kori Unit 1.	27 Dec 2017 to 31 Jul 2020 / 12 May 2017 to 28 Feb 2021	Periodic safety evaluation of the permanent shutdown and Wolsung nuclear power plants of Kori 1 (emergency plan and environmental impact part) It is a comprehensive and systematic safety reassessment performed at regular intervals for operating reactor facilities. In order to continuously improve the safety of the reactor facilities, the safety performance of the nuclear power plant during operation is periodically evaluated every 10 years.	16 May 2016 to 22 Aug 2016 / 24 Jul 2015 to 31 Oct 2015 / 1 Jul 2015 to 31 Oct 2015	Environmental investigation of radioactivity around Kori NPP, HanBit NPP, and HanUI NPP It is applied to the ODCM(Resident Exposure Capacity Evaluation) around nuclear power plants, and is a task to investigate the distribution of population within 80 km, production of agricultural products, livestock and fisheries, and marine activity hours of residents living on the coasts of Aug. -do and Gyeongsangnam-do.	09 Jun 14 to 25 Sep 2015	HanUI Unit 3&4 Disposal of Metallic Radioactive Waste The radioactive waste of solid metal generated from nuclear power plants is decontaminated below the "induced concentration" of each nuclear species using MCNP Code. As a result, it is determined that the RESRAD Code should be treated as a recycled product, a radiation exposure dose assessment is performed. After this is implemented, it must be licensed and treated as recycled products when it is completed.
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Capabilities and Experiences



Patent

10-0638400	Radioactive contaminant decontamination device	10-0638401	Portable high pressure water decontamination system
10-0676513	Decontaminating device of waste-oil radioactive	10-0676509	Keeping and drying case of spent filter
10-0676511	MRBC, Multi radwaste baler compactor	10-0818626	Apparatus for radioactive waste vacuum shrink-pack
10-1068190	MRBC, Multi radwaste baler compactor	10-1513092	A shielding frame for the install radiation shielding
10-1661899	Non power radioactive waste dryer	10-1643539	Multiplex decontamination equipment for radioactive waste of plate type
10-1661887	Auto device for surface milling about radioactivity waste	10-1907294	Apparatus for dissolution of radioactive wastes
10-1919275	Radioactive waste drum cutting device	10-1939540	Thermoluminescence dosimeter case automatic open system
10-0928652	Method and apparatus for decontaminating waste oils and waste cocktails containing Radioactive Materials		
10-0932670	Treatment method for waste scintillator containing radioactive materials		
10-0945744	Disposition method and its process for protective products manufactured by Polyvinyl alcohol		
10-0978312	Treatment method and its process for protective products manufactured by Polyvinyl alcohol		
10-2462259	Batch Pyrolysis Treatment Apparatus and Method of Super-Compacted Radioactive Waste drum using Induction Heating		
10-2462270	Batch Pyrolysis Treatment Apparatus and Method of Low-Level Radioactive Waste using Induction Heating		



NSSC-approved Agency Service for Radiation Protection



Removal of radioactive contamination

- In university research facilities, laboratories, etc.. 10 times per year



Supervising the installment of use facilities, etc.

- Supervision Report



Collection, treatment, and transport of radioisotopes and radioactive waste

- 7 times per year including Green Chemical Ltd.
- Types of Transportation : A-type, L-type
- Radionuclide : Kr-85, Ni-63, Pm-147
- Radioactivity : 555 Bq ~ 46620 MBq



Radiation safety management

- 26 companies including Crown Ltd.
- Using Radionuclide



Preparation of radiation safety report and safety management regulations

- 11 times per year including ChungNam University Hospital
- initial/changing for permit Sealed radioisotope



Other tasks related to the radiation safety management and the prevention from radiation hazards

- Leakage inspection of radiation sources (18 companies including ChungNam University Hospital)



Shielding & Total Analysis

Shielding Code for Radiation

2-Dimensions Shielding Code : Dot 4.2

3-Dimensions Shielding Code : MCNP Series (MCNP 6.2, MCNP 5, MCNP_X, etc.)

Neutron, photon, electron, or coupled neutron/photon/electron transport.

Specific areas of application include, but are not limited to, radiation protection

and dosimetry, radiation shielding, radiography, medical physics, nuclear criticality

safety, Detector Design and analysis, nuclear oil well logging, Accelerator target design,

Fission and fusion reactor design, decontamination and decommissioning.

The code treats an arbitrary three-dimensional configuration of materials

in geometric cells bounded by first- and second-degree surfaces

and fourth-degree elliptical tori

Calculation Code of Nuclear Critical

KENO-IV

KENO-V.a : Verification calculation

Use of SCALE Code System ORIGIN Code :

The Calculation of build-up, decay, processing with Radioactive Materials



Treatment Processing of Radioactive Waste

GASPAR (NRC DOSE, GAS DOSE) :

Evaluation of exposure dose for radioactivity that diffuses into the atmosphere during incineration

XQDOQ CODE : Evaluation of atmospheric diffusion during incineration

RESRAD CODE

RESRAD is a computer code developed at Argonne National Laboratory(ANL)

for the U.S. Department of Energy(DOE) to calculate site-specific residual radioactive aterial guidelines

and radiation dose/risk to an on-site individual (worker or resident) at a radioactively contaminated site.

• **RESRAD-ONSITE :**

For assessing radiation exposures of a human receptor located on top of soils contaminated with radioactive materials.

• **RESRAD-RECYCLE :**

For a computer code designed for evaluating radiation exposures resulting from recycle of contaminated scrap metals and reuse of contaminated furniture or equipment.

• **RESRAD-OFFSITE :**

For assessing radiation exposures of a human receptor located on top of or at some distance from soils contaminated with radioactive materials

• **RESRAD-BUILD :**

For assessing radiation exposures of a human receptor in a contaminated building or a building housing contaminated furniture or equipment

• **RESRAD-RDD :**

For evaluating human radiation exposures during the early, intermediate, or late phase of response after a radiological dispersal device (RDD) incident

• **RESRAD-BIOTA :**

For evaluating radiation exposures of nonhuman biota, including flora and fauna, in a terrestrial or aquatic ecosystem



Decommissioning

MARSSIM Method for Decontamination and Decommissioning of Radiation Controlled Area
(Multi-Agency Radiation Survey and Site Investigation Manual_EPA, NRC, DOE, DOD)



Applicable Codes & Regulations

Clearance and Exposure Dose

Regulations and guidelines related to Clearance

- IAEA Safety Standards Series No. RS-G-1.7 "Application of the Concepts of Exclusion, Exemption and Clearance"
- IAEA TECDOC-855 "Clearance Levels for Radionuclides in Solid Materials"
- DOE Order 5400.5 "Radiation Protection of the Public and the Environment"
- U.K. DETR Consultation Paper "The Radioactive Substances Act 1993 : Implementing The Revised Basic Safety Standards Directive Euratom 96/29"
- SSK "Procedures and criteria for the exemption from regulatory control of buildings with negligible radioactivity for demolition or continued utilization" (Germany)

Evaluation of Exposure Dose

- IAEA TECDOC-401 "Exemption of Radiation Sources and Practices from Regulatory Control"
- NUREG 1640 "RADIOLOGICAL ASSESSMENTS FOR CLEARANCE OF MATERIALS FROM NUCLEAR FACILITIES"
- IAEA Safety Series No. 111-P-1.1 "Application of Exemption Principles to the Recycle and Reuse of Materials from Nuclear Facilities"

Exposure Dose Assessment

- NRC Regulatory Guide 1.109 "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I"
- NRC Regulatory Guide 1.111 "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors."
- NRC Policy and Guidance Directive 8-10 "Disposal of Incineration Ash as Ordinary Waste"

Collection and analysis of representative samples of wastes subject to Clearance

- IAEA TECDOC-855 Clearance Levels for Radionuclides in Solid Materials: Application of Exemption Principles Interim Report for Comment
- IAEA TECDOC-1000 : Clearance of Materials resulting from the use of radionuclides in medicine, industry and research
- NRC Reg Guide 186 Termination of Operating Licenses for Nuclear Reactors
- DOE Order 5400.5 Radiation Protection of the Public and the Environment
- ANSI/HPS N13.12 Surface and Volume Radioactivity Standards for Clearance



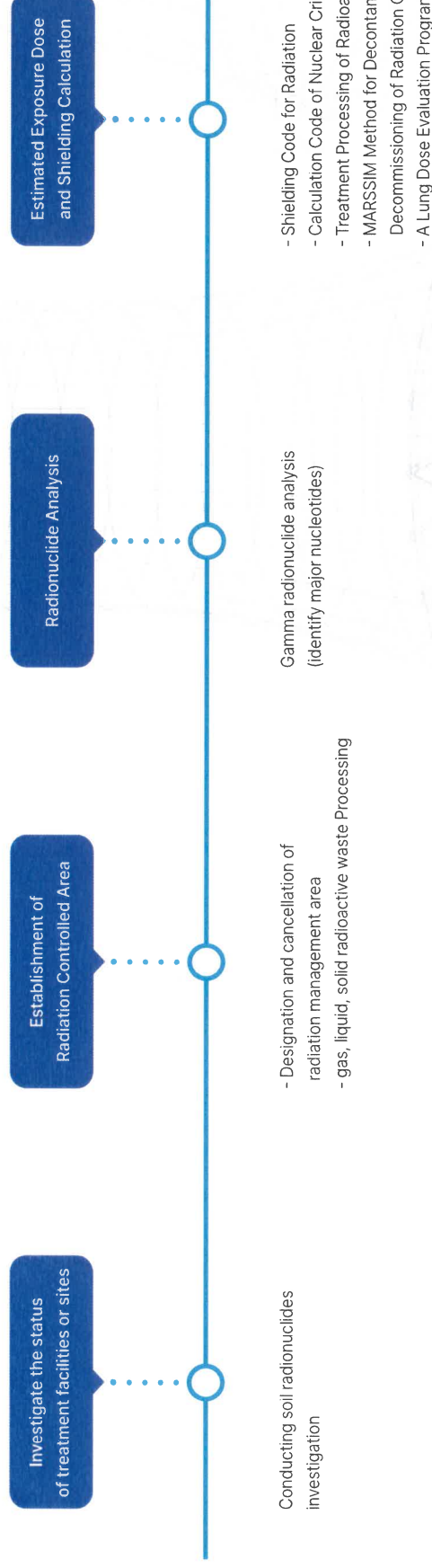
for Overall Radiation Protection

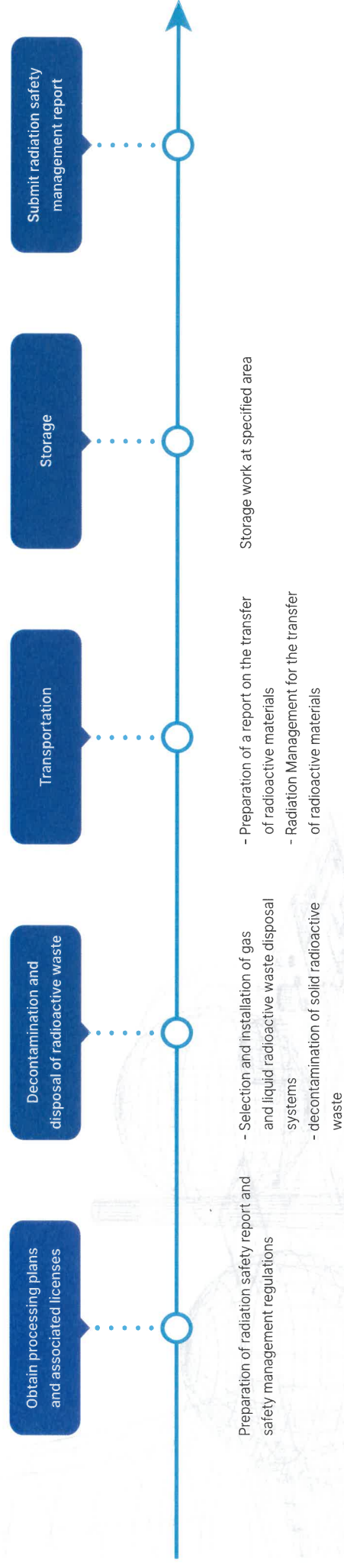
- IAEA TS-G-1.1, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material
- IAEA TS-R-1, Regulations for the Safe Transport of Radioactive Material
- ICRP 68, Dose Coefficients for Intakes of Radionuclides by Workers
- USNRC Regulatory Guide 1.8, "Qualification & Training of Personnel for Nuclear Power Plants"
- US NRC Regulatory Guide 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning"
- US NRC Regulatory Guide 8.2, "Guide for Administrative Practices in Radiation Monitoring"
- US NRC Regulatory Guide 8.4, "Direct-Reading and Indirect-Reading Pocket Dosimeters"
- US NRC Regulatory Guide 8.8, "Information Relevant to Ensure that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable"
- US NRC Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program"
- US NRC Regulatory Guide 8.10 "Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable"
- US NRC Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure
- US NRC Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection"
- US NRC Regulatory Guide 8.19, "Occupational Radiation Dose Assessment in Light Water Reactor Power Plants Design Stage Man-Rem Estimates"
- US NRC Regulatory Guide 8.25 "Air Sampling in the Workplace"
- US NRC Regulatory Guide 8.26 "Applications of Bioassay for Fission and Activation Products"
- US NRC Regulatory Guide 8.27, "Radiation Protection Training for Personnel at Light-Water- Cooled Nuclear Power Plants"
- US NRC Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure"
- US NRC Regulatory Guide 8.32, "Criteria for Establishing a Tritium Bioassay Program"
- US NRC Regulatory Guide 8.35, "Planned Special Exposures"
- US NRC Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus"
- US NRC Regulatory Guide 8.38, "Control of Access to High and Very High Radiation Areas in Nuclear Power Plants"
- US NRC Regulatory Guide 8.40, Methods for Measuring Effective Dose Equivalent from External Exposure
- 10CFR20, Standards for Protection Against Radiation
- WANO GL 2004-01(Rev.1), Guidelines for Radiological Protection at Nuclear Power Plants
- SOER 2001-1, Unplanned Radiation Exposures
- Nawah Energy Procedure RP-PGD-0001 "Radiation Protection Program"

Total Management Service for RP & RW

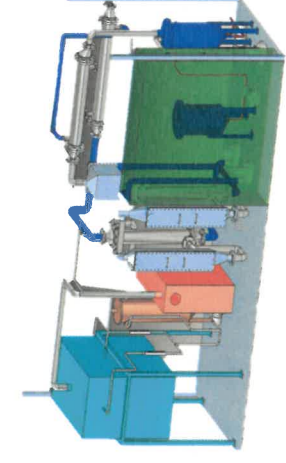


Process Design





System & Instrument Design

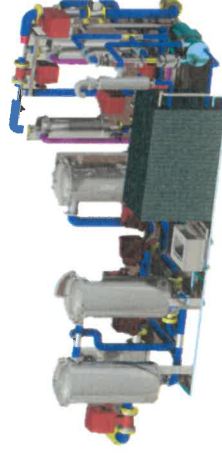
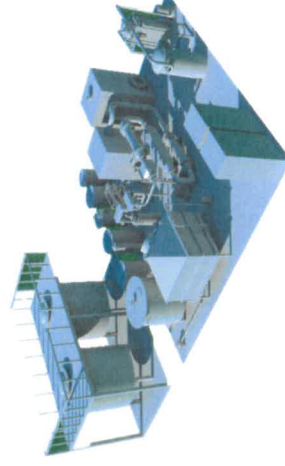
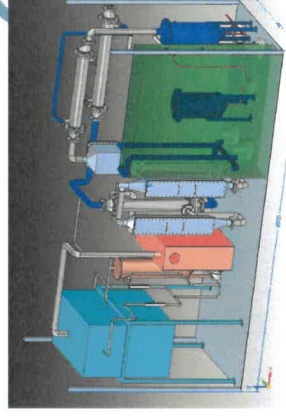
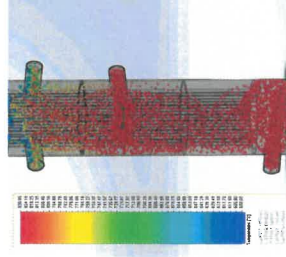
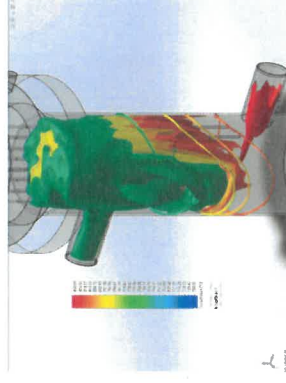
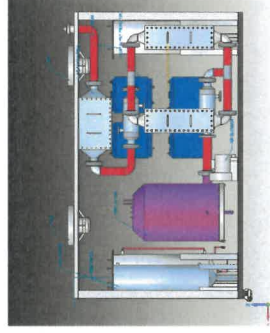
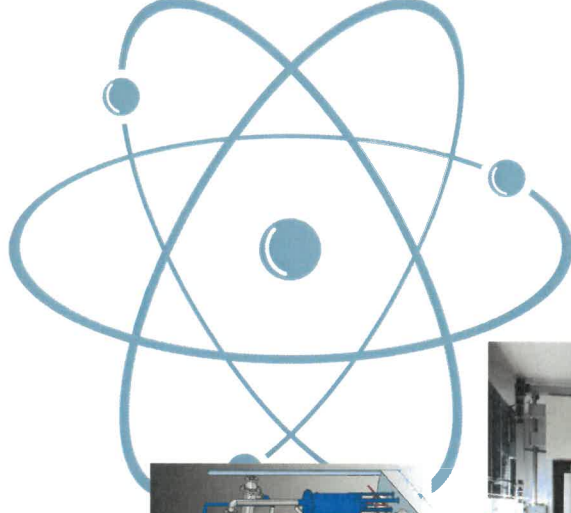


- 25kW MCFC Steam Generator / desulfurization system
- Separation and Recovery Process Pilot for High Efficiency CO₂ Absorbers
- High temperature pyrolysis/combustion reactor system
- Adsorption Tower Performance Evaluation System
- 30kW MCFC Steam Generator / desulfurization system
- Hydrogen Generator/Aromatic Extractors

Advanced Process Modeling & Simulation

- Hydrogen Diffusion Experimental Model
- 100kW MCFC Pre-Reformer/Desulfurizer
- BPR/View Cell Reactor System
- 300 kW MCFC Pre-Reformer/Desulfurizer / VOC / Remover Oxidation
- O₃ Reaction Process
- CO₂ Capture Apparatus Process
- Design and Manufacture of Waste Fluorescent Oxidizing System

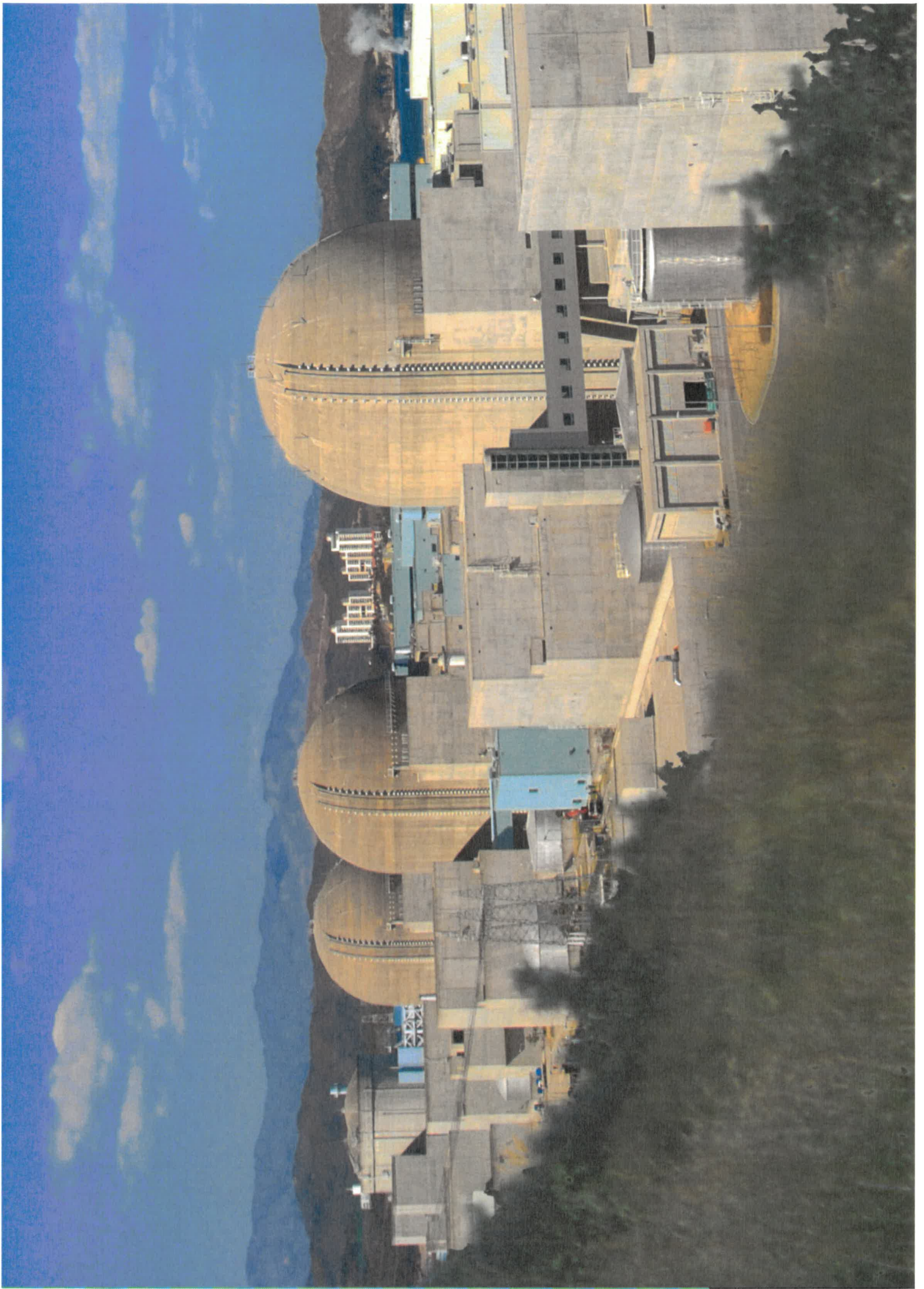
- supercritical reactor
- PVA Processing unit Design
- Design of Dissolved Oxygen Removal System for Nuclear Power Plants
- Design of Cleaning Waste Disposal System for Nuclear Power Plants
- ACF System Design

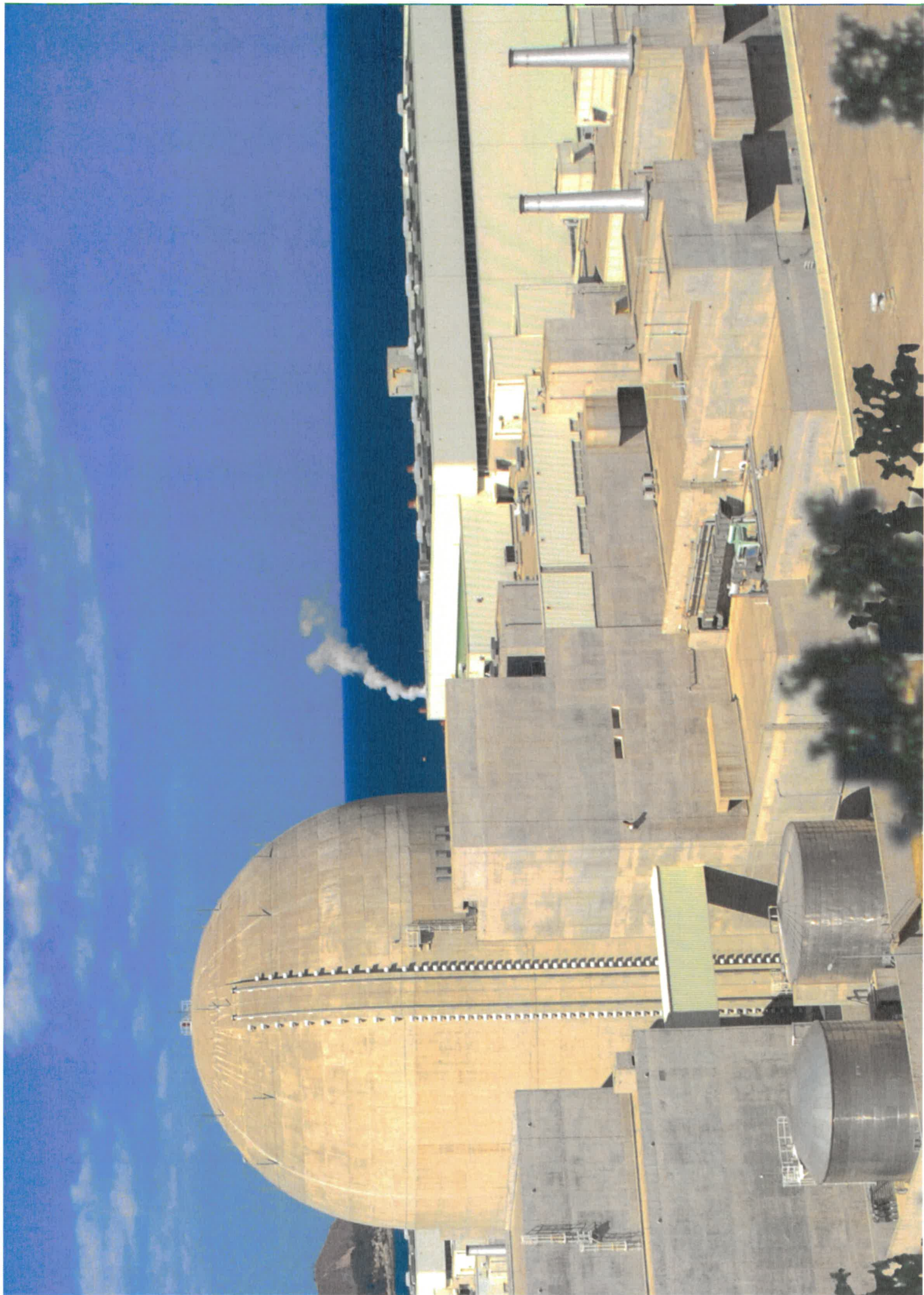


- 2L/Hr WGS Process Design and Manufacture
- PAR prototype Design and Manufacture
- Separator Flow Analysis
- 1NM³/Hr WGS Process Design and Manufacture
- Design and Manufacture for Catalyst regeneration equipment during operation
- PVA Processing Unit 3D Design(400 lbs/batch)

- 60,000 Kcal/hr Heat Exchanger Design
- 15 MW FE-IGCC PLANT Design and Manufacture
- H-3 Measuring device Design and Manufacture
- 10 kW CO₂ Utilization High-load Compound Production System
- 50m³ BSU CO₂ Recovery and Separation system
- Flow layer CO₂ Removal Device
- Plasma gas treatment system

- Radioactive waste-activated carbon treatment system
- Development of Air Purifier using CO/HCHO Catalyst
- WGS Process
- Inspection Instrument for Clearance
- Radioactive Surveymeter for Construction waste
- Flow Analysis of Separator Performance Evaluation





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