Environmental Monitoring Program in IRAN

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National Radiation Protection Department
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Status of main Law:

- Atomic Energy Organization of Iran Act (AEOI Act -1974)
- Radiation Protection Act of Iran (RPAI – 1989)
- Basic Radiation Safety Standards (BRSS-1999)
- Act on Safe and Peaceful Utilization of Nuclear Energy (2007)
Iran Nuclear Regulatory Authority (INRA)

- Iran Nuclear Regulatory Authority (INRA) is a technical expert organization.
- The legal authority for granting the licenses and to regulate the siting, design, construction, commissioning and operation of Nuclear Facilities is delegated to INRA.
- INRA has been reestablished to ensure that the use of nuclear energy in Iran is safe, well regulated and environmentally sound.
National Radiation Protection Department (NRPD)
Environment Radiological Protection Division (ERPD)

- Radioecology Group
- Mines Radiological monitoring Group
- Air Radioactivity Monitoring Group
- Marine Radioactivity Monitoring Group
- Counting and Spectrometry Group
History

- Environmental radiation monitoring began in 1978 by measuring the concentrations of some radionuclides in air, water, soil and food samples in Bushehr and Isfahan provinces. The results of these measurements represent the normal levels.

- After the Chernobyl accident main activities focused on environmental radiation measurement, including artificial radionuclides such as $^{137}$Cs in soil and food samples.
ERPD main research involvements are:

- Exposure of Iranian to natural radioactivity;
- Preparedness for nuclear and radiation accidents: developing methods to protect and restrict the harms of radioactive fallout, and to follow and predict the radiation situation; Radiation detection methods;
- Study on High Level Natural Radiation Areas (HLNRAs) in Iran;
- National regulatory framework for the control and monitoring of public exposure;
- Control and monitoring of radioactive discharge;
- Radiation monitoring program in the vicinities of the Iranian Nuclear Facilities;
- Radiation monitoring program in the Caspian Sea, Persian Gulf and Gulf of Oman.
Monitoring Scope:

To protect the health of the public
To preserve the environment

<table>
<thead>
<tr>
<th>Nationwide territory monitoring program</th>
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<tbody>
<tr>
<td>o Land monitoring for global fallout surveillance</td>
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<td>o Marine monitoring for global fallout surveillance and radioactive discharge</td>
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<th>Nuclear facilities sites monitoring program</th>
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<tr>
<td>o On site and off site monitoring</td>
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<td>o Comparative areas monitoring</td>
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<td>o Around discharge seawater monitoring</td>
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- Early detection of radioactive contamination all across Iran resulting from atmospheric weapon testing and nuclear or radiological accidents in Iran and neighboring countries
- Ensure base-line data for evaluation of environmental impact due to radioactive materials when nuclear accidents occur
- Evaluation of environmental impact by radioactive debris released from nuclear facilities
- Estimation of accumulation trend of radionuclides in the environment around nuclear facilities
Legal Basis:

The Atomic Energy Act and The Radiation Protection Act of Iran

Global Fallout Surveillance

The INRA shall monitor radiation and radioactivity in the environment in all parts of the nation and evaluate its results to protect the health of the people and preserve the environment against radiation

Radiation Surveillance in the Environment around Nuclear facilities

(1) Installers and operators of nuclear facilities shall perform the environmental radiation monitoring and environmental impact assessment
(2) The INRA can make a radiation environmental investigation in order to confirm the results of the environmental radiation monitoring and environmental impact assessment which installers and operators of nuclear facilities report, if it is necessary.
Nationwide Radiation Monitoring
Early Warning Environmental Radiological Monitoring Systems (EWERMS)

- Up to now 63 stations of early warning network has been designed and installed by Iranian experts. (It would be increased to 300 in the end of 2012)

- The background radiation in Iran ranges from 0.05 to 0.180 µSv/h

- The monitoring results of the network are updated to NRPD’s webpages once an hour.

- Each station includes, GM detector, Data logger and etc.

- The place of detectors has been modified according to long range modeling codes by considering 3 factors (radioactivity, economic, population)
Graphical User Interface

Objective and Functions of the EWERMS

Objective
- Early detection of radioactive contamination in the environment resulting from nuclear or radiological accident

Functions
- Real time on-line monitoring of nationwide environmental radiation
- Operation of early warning system
  - To provide the government with timely information on abnormal environmental radiation
  - and enable them to take an appropriate countermeasure
  - and to inform the public
Exposure of Iranian to natural radioactivity
Soil Sampling Location:
Exposure of Iranian to natural radioactivity

<table>
<thead>
<tr>
<th>Radionuclides</th>
<th>Min (Bq/kg)</th>
<th>Max (Bq/kg)</th>
<th>Avg. (Bq/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cs-137</td>
<td>0.8</td>
<td>89.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Ra-226</td>
<td>2</td>
<td>68</td>
<td>25.7</td>
</tr>
<tr>
<td>Th-232</td>
<td>1.3</td>
<td>70.3</td>
<td>24.3</td>
</tr>
<tr>
<td>K-40</td>
<td>13</td>
<td>1040</td>
<td>457</td>
</tr>
</tbody>
</table>

Gamma dose rate in Iran (nSv/h)
Iranian annual per capita radiation dose from natural sources (msv)

- Terrestrial: 0.37 msv (16%)
- Cosmic: 0.24 msv (10%)
- Potassium40: 0.18 msv (8%)
- U/Th: 0.02 msv (1%)
- Radon: 1.5 msv (65%)
Marine environmental assessment
Marine environmental assessment

- The focus of the marine monitoring is to assess the radiation doses to the public arising from discharges from the NPPs around and to assess the geographic and temporal distribution of artificial radionuclides in the marine environment.

- The anthropogenic radionuclides of greatest concern are: caesium-137, Strontium-90 and isotopes of plutonium. These three radionuclides are measured in seafood to determine the ingestion dose to the public.

- Also they should be measured in seawater and seaweed to assess geographic and temporal trends.

- Caesium-137 is also measured in sediment samples.
Marine environmental assessment will be performed by:

Scientific cruises with cooperation of other national organizations with main following objectives:

- To assess contaminants in the marine environment, with a focus on anthropogenic radionuclides.

- To study oceanographic processes which control the fate of pollutants (such as fluxes of suspended matter, sedimentation, water mass mixing) using radionuclides as tracers and also to find the modeling of pollutants (radioactive and nonradioactive) distribution in the marine environment.

- To perform trend monitoring at reference stations
The Sampling stations:

ROPME Sampling Location
High level of Natural Radioactivity in the world
High level of Natural Radioactivity in the world

- Norway 0.63 (10.5)
- Denmark 0.33 (0.45)
- Germany 0.48 (3.8)
- India 0.48 (9.6)
- Japan 0.43 (1.26)
- USA 0.40 (0.88)
- Kerala (India) 3.8 (35)
- Ramsar (Iran) 10.2 (260)
- Yangjiang (China) 3.51 (5.4)
- Guarapari (Brazil) 5.5 (35)

( ) maximum value
The laboratory is responsible for research and environmental radiation monitoring related to high level natural radiation background areas in North of Iran.

It studies the transferation and accumulation of radionuclides in different environmental samples (air, water, soil and plants), and in locally produced foodstuffs, drinking waters and samples taken from hot springs.
Regional Laboratory in North of Iran (High Level Natural Radiation Areas) (con.)

The aims of the research carried out are:

• to perform radioactivity analyses of environmental and food samples in the north of Iran in order to improve dose assessments

• and develop practical measures if it would be need related to high level natural radiation background in some points

HLNRAs in Ramsar
Nuclear Facilities Sites Monitoring Program
Nuclear facilities:

1- Nuclear Power Reactor- VVER 1000MW
2- Zero Power Reactor
3- Research Reactor - 5 MW
4- Research Reactor – 40 MW (Under construction)
5- Uranium mine
6- Uranium enrichment facilities
7- Nuclear Fuel Cycle
According to the FUNDAMENTAL SAFETY PRINCIPLES:

- The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks (Principle 1: Responsibility for safety).
- The operator shall ensure that radioactive substances from authorized practices and sources not be discharged to the environment unless the public exposure committed by the discharges are limited by Iranian Nuclear Regulatory Authority (INRA).
- The operator shall be responsible for ensuring the provision and maintenance of adequate monitoring to measure radioactive releases during the operation, and shall take necessary actions to ensure that the requirements established by INRA are met.

- Monitoring and measurements shall be conducted of the parameters necessary for verification of compliance with the requirements of established by INRA
ERPD Capabilities
Capabilities (cont.)

- Test of radiation safety and related environmental sampling
- Advanced gamma spectrometric analyses (all gamma-emitting nuclides), Determination of natural and artificial radionuclides in environmental and biological samples by gamma spectrometry.
- Determination of 
  - Sr-90 in milk, sediment, fish flesh soil, plants, foodstuffs and mineral matrix.
  - Ra-226 & Ra-228 in food stuffs.
  - Utot. , Ra-228, Ra-226 & Rn-222 in water, sediment and fish flesh.
    - Po-210 in environnemntal samples, sediment and fish flesh.
  - Pu-239+240 in water, soil, sediment, plants and food stuffs.
  - H-3 in water.
  - DU in sediment and soil samples.
  - Radon decay products in airborne
  - Long lived Radionuclides in dust
  - Determination of natural (Be-7) and artificial Radionuclides (Cs-137, I-131) in air filters.
Capabilities (cont.)

- Radiochemical analyses (tritium, Sr, Pu and Am isotopes)
- Airborne radon concentrations
- Natural radionuclides in water (Rn, Po, Pb and U isotopes)
- Sampling nearby nuclear power plants in terrestrial, air and marine environments
- Most of the requirements are based on the standard ISO/IEC 17025 and more attention and support is required for implementing ISO/IEC 17025 standard in Analytical laboratories.
Quality Assurance and International Cooperation Activities

For Quality Assurance aims the ERPD laboratories participate in many Proficiency and intercomparision tests. Some of them are presented below:

- Sr-90 measurement in mineral matrix (1999).
- Intercomparison test for determination of alpha emitting radionuclides in urine (2000).
- Participating in the regional project in QA of Analytical Laboratories, based on ISO 17025 (2004-2005)
- ALMERA soil sampling proficiency test (14-18 November 2005)
God will not seek thy race,
Nor will He ask thy birth
Alone, He will demand of thee
"What hast thou done with the land that I gave thee?"

Persian Proverb

Thank You for Your Kind Attention