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June 15, 2010
L-2010-132

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Generic Fundamentals Examination Comments

As stated in the NRC's letter dated May 27, 2010, FPL is allowed the opportunity to make comments on the written Generic Fundamentals Examination (GFE) that was administered at Turkey Point Nuclear Plant on June 9, 2010.

This letter documents that Florida Power and Light Company (FPL) is submitting comments for GFE Question #6 for your evaluation and resolution before final exam grading. Specifically, FPL is requesting NRC to consider two answers to GFE Question #6. The basis for this request is presented in Attachments 1, 2 and 3 respectively.

Should you have any questions, please contact Mark Similey at (305) 246-6691.

Very truly yours,

Neil Constance

Neil Constance
Training Manager
Turkey Point Nuclear Plant

SM

cc: Regional Administrator, Region II
Chief, Operator Licensing and Human Performance Branch, Region II, USNRC
Chief Examiner, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant
Sonalysts, Inc. 215 Parkway North, Waterford, CT 06385

A001
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QUESTION # 6 FORM A

Question 6 states:

"During power operations, a reactor coolant sample is taken and analyzed. Which one of the following lists three nuclides that are each indicative of a possible fuel cladding failure if found to be at elevated concentrations in the reactor coolant sample?

A. Oxygen-18, iron-59 and zirconium-95

B. Cobalt-60, iodine-131 and xenon-135

C. Krypton-85, strontium-90 and cesium-136

D. Hydrogen-2, hydrogen-3 and nitrogen-16"

Discussion and Basis for Request

Per the exam answer key the correct answer is C. Certainly this is correct as all are fission products.

However, it can be shown that elevated levels of CRUD, reference attached report (Attachment 2) for Nuclear Engineering International (NEI) regarding fuel & fuel failure cycle, is a common component in fuel failures. In fact this report indicated that 13% of all fuel failures are directly attributed / traceable to CRUD and corrosion.

Additionally, as indicated on page 7-7 of USNRC Technical Training Center's Reactor Concepts Manual regarding Radiation Sources at Nuclear Plants (Attachment 3) Cobalt-60 is a common activation product and a component of CRUD.

Therefore, it would be reasonable to assume that increased levels of CRUD... and therefore increased levels of Cobalt-60... could also be indicative of a possible fuel cladding failure. Since Iodine-131 and Xenon-135 are fission product nuclides with half-lives long enough to provide indication of a fuel leak we believe B to also be correct.

FPL Request

FPL requests that both answers B and C to Question #6 be considered correct.

ATTACHMENT 2

L-2010-132

NEI REPORT "FUEL FAILURE PHASEOUT" 01 SEPT 2008

(SEE ATTACHED)

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FEATURE

Fuel & fuel cycle

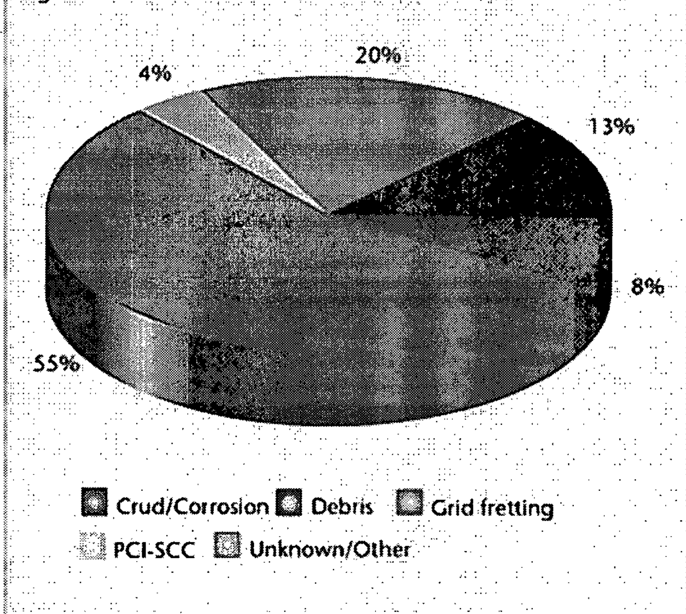
Fuel failure phaseout

01 September 2008

EPRI has developed a series of guidelines to help eliminate fuel failures at nuclear power plants, with the aim of achieving INPO's goal of zero fuel failures by 2010.

Fuel failures have been traced to several different causes (see Figure 1). The most common are corrosion and crud, mechanical fretting wear (foreign material such as a piece of wire vibrating against the fuel rod surface), and pellet cladding interaction (PCI – stress buildup on the cladding due to contact with the fuel pellets and interaction with the aggressive radioactive environment on the inside of the fuel rod).

Figure 1: Causes of fuel failures 2000-2007



The total number of fuel failures, for both BWR and PWR plants combined, is significantly lower today than in past decades. However, while the industry has moved in the right direction, the number of fuel failures since 1990 has not markedly decreased (see Figure 2).

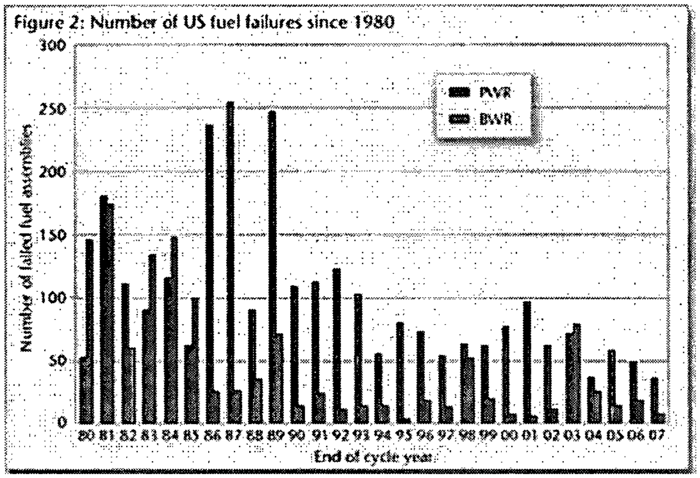


Figure 2: Number of US fuel failures since 1980

In 2006, the Institute of Nuclear Power Operations (INPO) set an ambitious goal to achieve zero fuel failures by 2010. In response, US nuclear owners and operators backed a fuel integrity initiative that emphasised the development of fuel reliability guidelines. In the first instance, INPO led the development of guidance documents summarising current industry information to assist utilities in improving fuel integrity and performance.

EPRI Guidelines

The Electric Power Research Institute's (EPRI's) fuel reliability programme, headed by programme manager Kurt Edsinger, has since led a coordinated effort to develop technical guidelines in the following five areas:

- Fuel surveillance and inspection.
- PWR fuel cladding corrosion and crud.
- BWR fuel cladding corrosion and crud.
- Pellet cladding interaction (PCI).
- Grid-to-rod fretting (GTRF).

The guidelines capture state-of-the-art industry knowledge, providing specific guidance and good practices to help utilities avoid fuel failures associated with specific failure mechanisms.

More than 70 utility experts and 26 vendor experts have actively participated in developing the guideline documents, along with EPRI, INPO, the Nuclear Energy Institute and industry consultants. In addition, all the US nuclear utilities and five international utilities have been involved in a review process facilitated by EPRI working groups and the *Zero by 2010* industry group. In total, about 200 people have reviewed the guidelines to ensure their accuracy and relevance to fuel reliability issues.

David Schrire, nuclear fuel design and materials manager for Vattenfall Nuclear, who was involved in the working group for the PCI guidelines, said: "We have obtained some ideas for good practices that can be incorporated into our own procedures; ideas we would have otherwise been unaware of."

Guido Ledergerber, head of nuclear operation for Kernkraftwerk Leibstadt, explained that although the guidelines have been developed for US utilities they could also benefit European utilities. "The very structured way those guidelines have been approached has convinced me that this is also great value to us," he said.

Guideline Format

Each guideline document presents recommendations in three categories, consistent with industry practice. These are:

• Mandatory: implemented at all plants where applicable.

• Needed: implemented wherever possible, but alternative approaches are acceptable.

• Good practice: expected to provide significant operational and reliability benefits, but implementation is left to the discretion of the utility.

Fuel surveillance and inspection

The EPRI guidelines should help plant operators: develop fuel surveillance and inspection programmes that will identify margins in key fuel performance characteristics for currently operating fuel designs; assess margins in key fuel performance characteristics following changes in fuel design, manufacture and operation; and provide guidance on failed fuel action planning.

The fuel surveillance and inspection guideline document includes three mandatory recommendations to: establish a unit-specific surveillance and inspection programme for non-failed fuel; establish a programme to prevent the reinsertion of failed fuel; and perform causal analysis to establish apparent cause of failure. Needed recommendations are to: perform baseline 'healthy fuel' inspections (for PWRs visual, oxide, and grid-to-rod fretting measurements, and for BWRs visual and oxide measurements); evaluate the need for inspections following significant changes or events (*eg* changes in fuel design, water chemistry, core design and operational strategy); and enter inspection scope into the EPRI Fuel Reliability Database (FRED).

PWR cladding corrosion and crud

Fuel reliability recommendations for PWRs are derived from analysis of the four crud-induced corrosion failures in the USA since 1990. These guidelines contain information relating to the impact that various changes in core design, assembly mechanical design and chemistry can have on corrosion product deposition on the fuel.

The PWR guidelines include one mandatory recommendation to include a crud-induced corrosion risk assessment as part of the core design process for each cycle. Five needed recommendations are:

• Assess effect of core and fuel design changes on critical factors controlling crud deposition, and take action to reduce crudding risk.

• Minimise locally high steaming rates on small fuel rod surface areas.

• Maintain reactor coolant pH=7.0 while at full power xenon-equilibrium conditions. Beginning-of-cycle pH should be as high as achievable within industry experience and vendor specified lithium restrictions.

• Analyse reactor coolant during shutdown and startup at a frequency allowing reasonable estimates of nickel, iron and cobalt-58 releases and removal.

• Optimise plant operating parameters that can affect sub-cooled nucleate boiling at all times during operating cycle.

BWR cladding corrosion and crud

The BWR guidelines, based on BWR fuel operational experience over the last 30 years, define approaches that utilities can take to ensure that cladding materials provided by the fuel suppliers meet quality requirements with respect to corrosion resistance, and provide recommendations on controlling water chemistry impurities and additives to minimise crud and cladding corrosion.

The BWR guidelines include one mandatory recommendation to include a crud and cladding corrosion risk assessment for each cycle. Needed recommendations address cladding materials, chemistry parameters, and fuel duty, as well as fuel fabrication quality assurance and fuel handling. These are to:

• Provide fuel vendor with anticipated fuel operating and environmental conditions for the reload.

• Review vendor's fuel fabrication quality assurance programme and planned quality control checks.

• Implement fuel handling procedures that provide for protection from mechanical damage and surface contamination until stored under water.

- Review vendor-proposed changes in cladding alloy chemistry or material processing specifications.

- Ensure that new zirconium alloys will meet the corrosion, hydriding and mechanical property requirements of fuel designed for high exposure applications.

- Maintain feedwater oxygen within BWR chemistry guideline limits to minimise flow assisted corrosion of carbon and low alloy steels.

- Assess risk of adverse fuel impacts before increasing quarterly average feedwater zinc concentration >0.5ppb or the cycle average feedwater zinc concentration >0.4ppb.

Grid-to-rod fretting

The grid-to-rod fretting guidelines, released in late July, address the failure mechanism responsible for more than 70% of all fuel failures. The mandatory recommendations are: perform an initial assessment of the fuel in-core margin to GTRF failure; during each cycle, evaluate the impact of changes in fuel design and operating conditions on GTRF resistance; and utilities that have experienced a GTRF failure with their current fuel design shall develop a GTRF action plan to determine activities necessary to eliminate GTRF failures.

There is one necessary recommendation that utilities with unknown margin to GTRF failure shall perform poolside examinations to quantify the available margin.

Further guidance

The PCI guidelines, due to be published later this year, will help utilities assess their margins to PCI relative to current fuel vendor recommendations and plant-specific operating conditions. The recommendations are supported by operational experience and EPRI and vendor fuel performance codes to ensure that stresses do not exceed a threshold that could lead to fuel failures.

Implementation

Achieving zero fuel defects by 2010 demands a concerted effort by utilities, fuel suppliers, and other industry organisations. US nuclear power plants will have about six months to incorporate the EPRI guidance into their fuel reliability programmes after guideline release. However, actual implementation of the mandatory, needed and good practices, particularly those associated with fuel design changes, will take longer.

Attachment 3

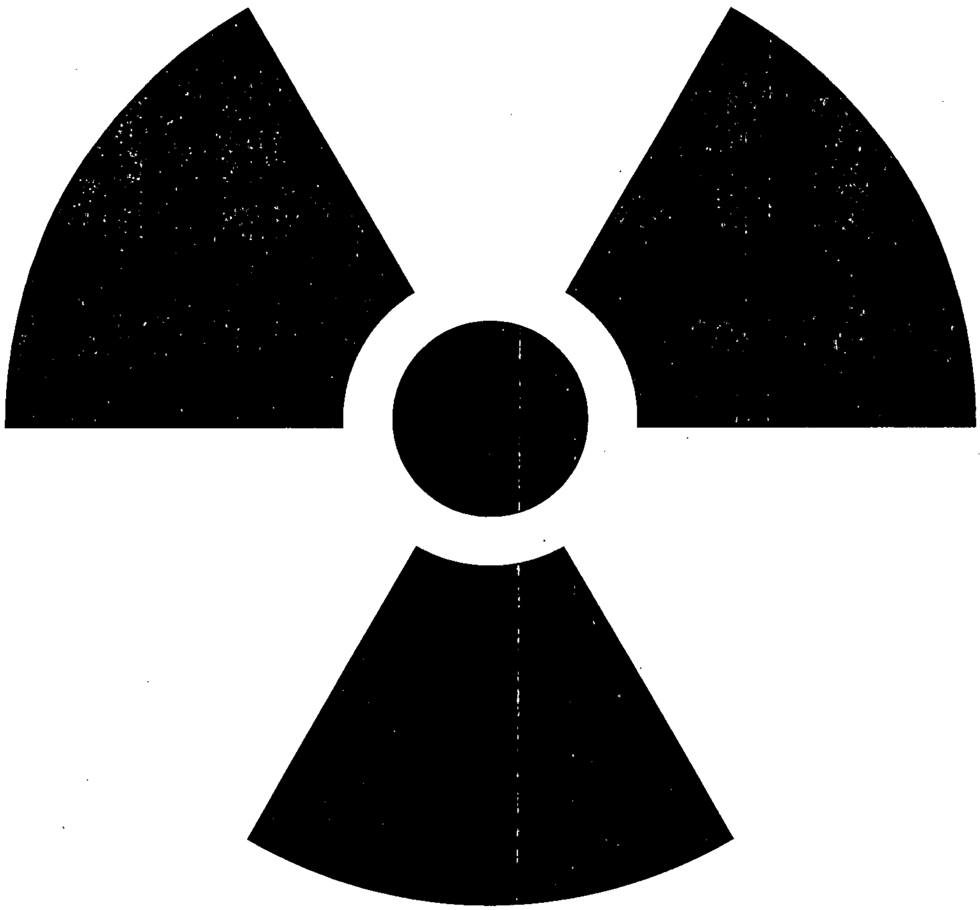
L-2010-132

USNRC Technical Training Center Reactor Concepts Manual

RADIATION SOURCES AT NUCLEAR PLANTS

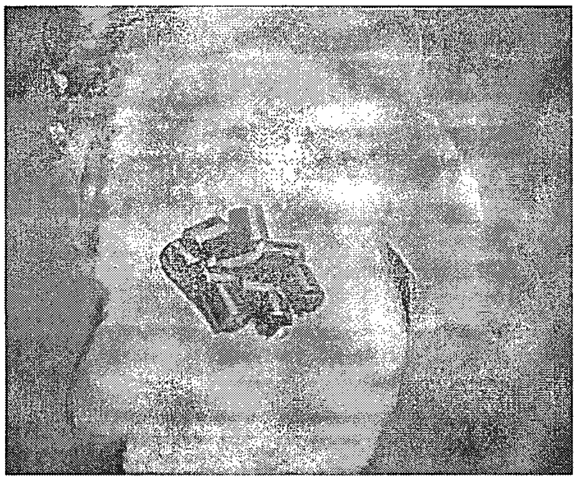
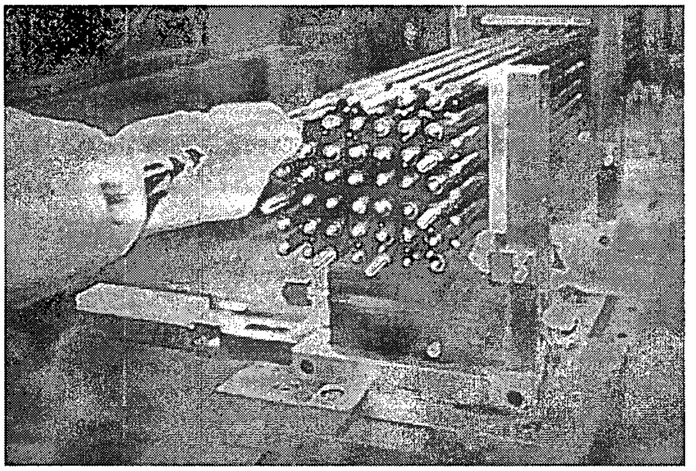
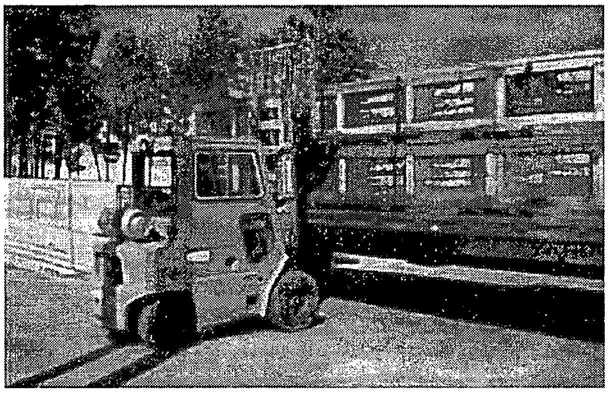
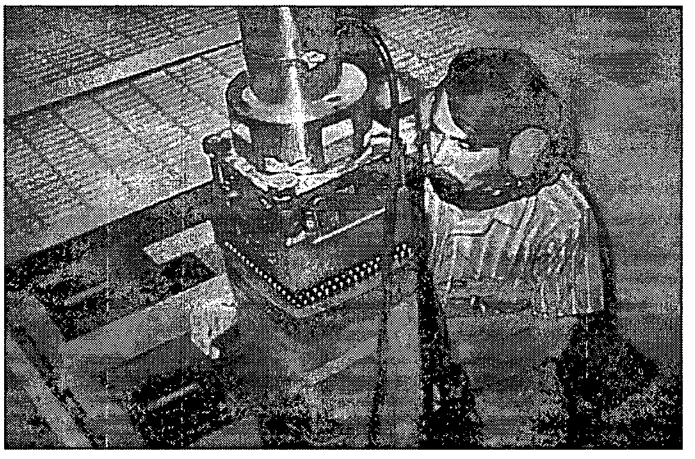
(SEE ATTACHED)

Radiation Sources at Nuclear Plants



This chapter will discuss the sources of radiation at nuclear power plants. These sources are:

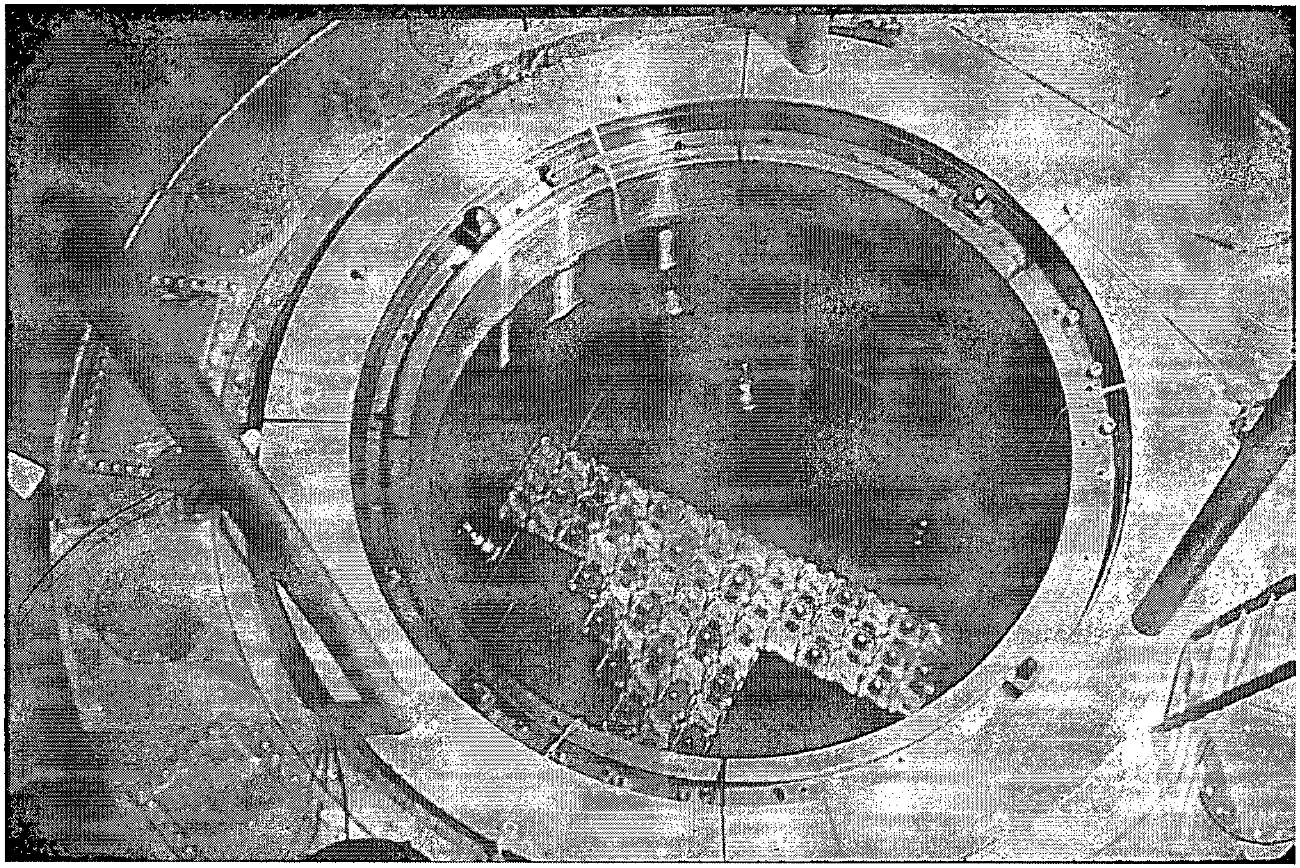
- Nuclear fuel decay
- Fission process
- Fission product decay
- Activation products
- Calibration sources

Nuclear Fuel Natural Decay Process

Uranium-238 (about 96% of the fuel) and uranium-235 (the remaining 4%) are naturally radioactive and disintegrate (decay) by the emission of alpha particles and gamma rays into daughter products. Beta particles are also released from the fuel as the daughter products continue the natural decay process toward a stable form (lead). Since the fuel is sealed in airtight fuel rods, there should be little or no alpha or beta radiation problem at the nuclear plant due to the natural decay of the fuel unless there is some fuel rod damage.

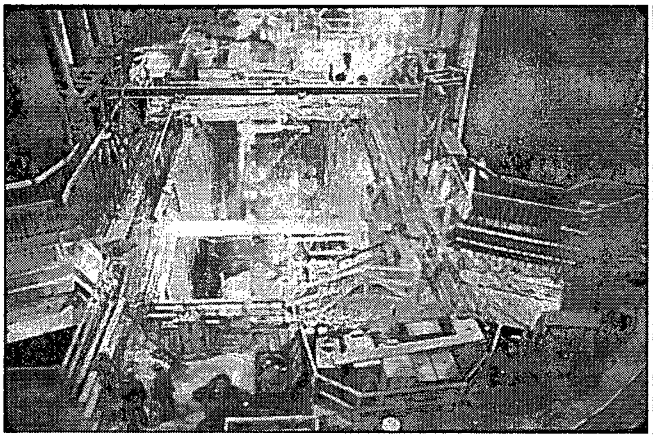
The natural decay process of the fuel is not a major contributor to a worker's dose at the power plants. This is because of the low radiation levels associated with fuel that has not operated in the reactor core.

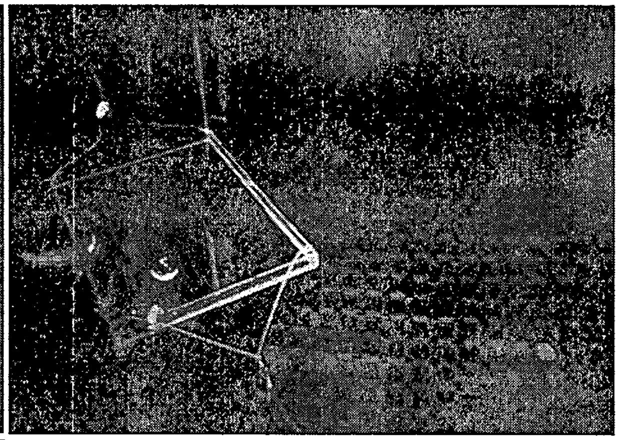


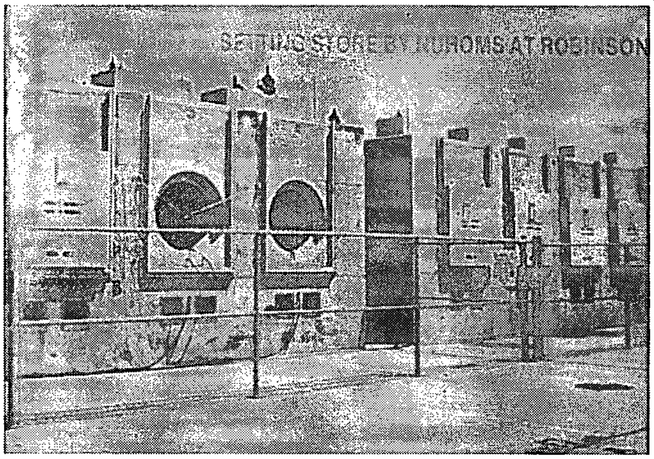
Fission Process

During the fission process, uranium atoms split into two or three smaller atoms, which are called fission products. Powerful (high energy) gamma rays and high speed neutrons are released during and immediately following the fission process. Since neutrons and gamma rays can travel long distances in air, very high radiation levels are present in the vicinity of the reactor vessel during power operation.

The fission process is not a major contributor to a worker's dose at the power plants. This is because the fission process is occurring in the reactor core which is contained in the reactor vessel. The reactor vessel is located within the reactor cavity inside the containment, and workers are not normally allowed around the reactor vessel during operation.



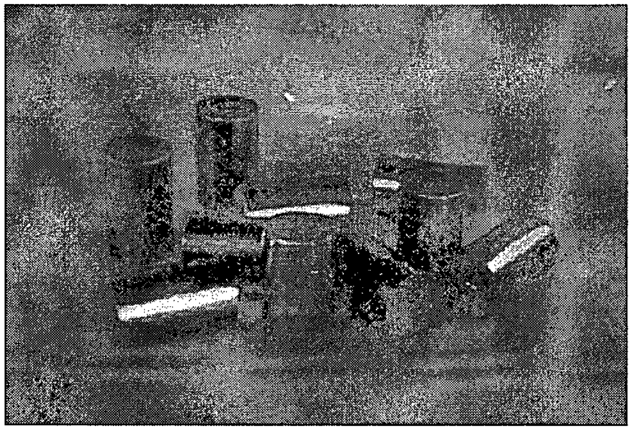


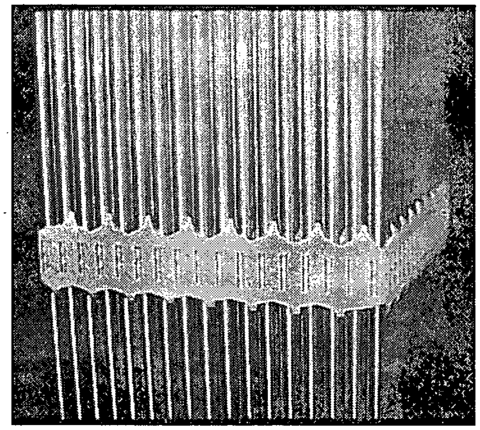


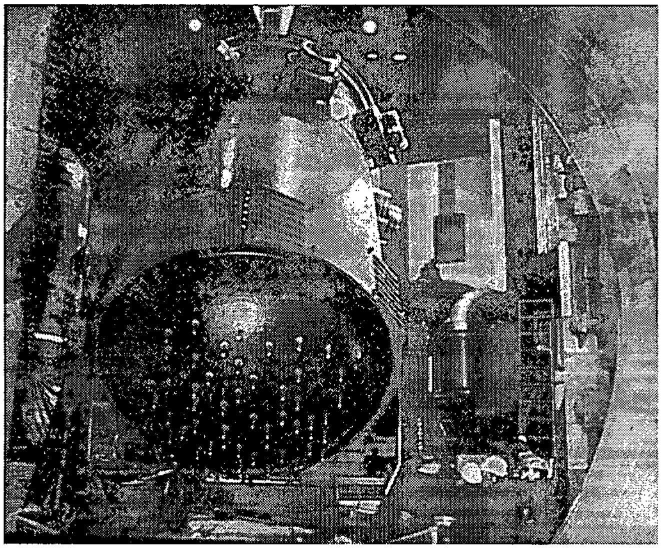
Fission Product Decay

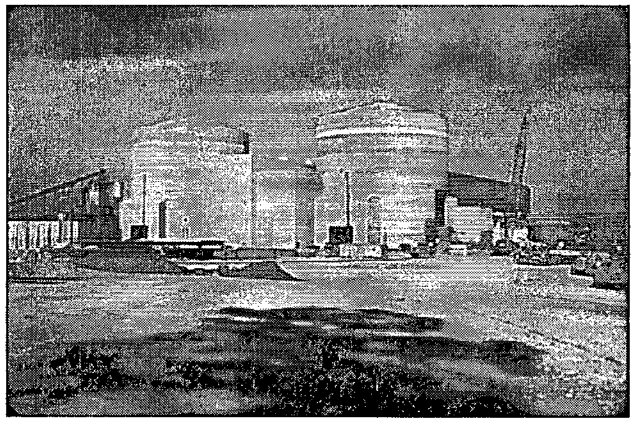
The fission products, which are produced by the fissioning of the uranium fuel, are intensely radioactive. Most of these fission products will decay rapidly, since they have very short half-lives. However, several have very long half-lives and decay very slowly. Fission products generally decay by beta and gamma emission.

The decay of the fission products generally occurs within the reactor vessel, and, therefore, they are not a significant contributor to the radiation dose of workers at the power plant during operation. The gamma rays contribute to the radiation levels near the reactor vessel. Since workers are not normally present in the vessel area during operation, they are not a significant source of exposure. During refueling, however, the fuel is removed from the reactor vessel. At this time, the workers could be exposed to the radiation from the fission products. However, refueling is performed under water to limit the radiation dose the workers receive.





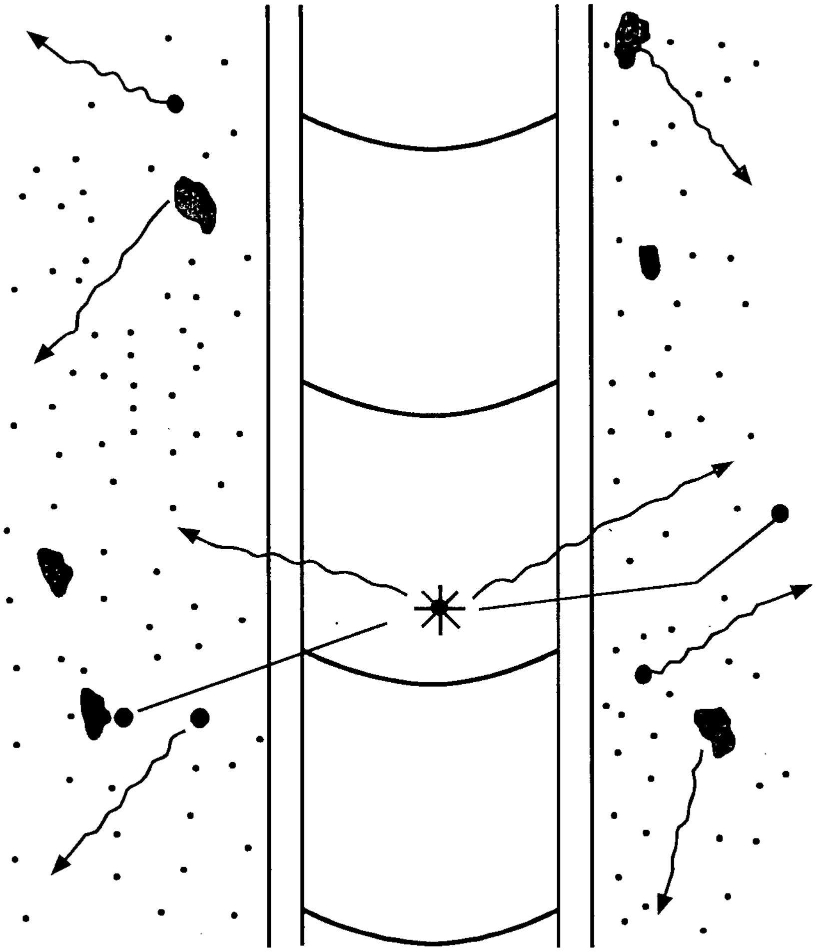




Fission Product Barriers

Since a significant fission product release could seriously jeopardize public health and safety (and the environment), a system of fission product barriers is part of every power reactor design. The barriers are designed to keep the highly radioactive fission products from reaching the environment by keeping the fission products within the reactor core area.

Most of the fission products will stay in the pellet. But, if the pellet is damaged or due to natural diffusion, the fission products could get out of the pellet into the fuel rod. Since the fuel rods are contained within the reactor vessel, any leakage from the fuel rods will be contained within the reactor coolant system. If the reactor coolant system loses its integrity, the containment would contain the fission products.



Activation of Water & Corrosion Products

Some materials in the vicinity of the reactor core (impurities in the reactor coolant and the reactor coolant itself) will absorb some of the neutrons produced during the fission process and will be changed from a stable form to an unstable (radioactive) form. This process is called activation, and the radioactive isotopes formed are called activation products. These activation products are located in the reactor coolant system, unlike the fission products which are located inside the fuel rods, and are, therefore, easily transported by the reactor coolant system to any support system that connects to the reactor coolant system. Activation products are the source of most radioactive contamination at nuclear power plants and are also the source of most occupational radiation exposure at the plants.

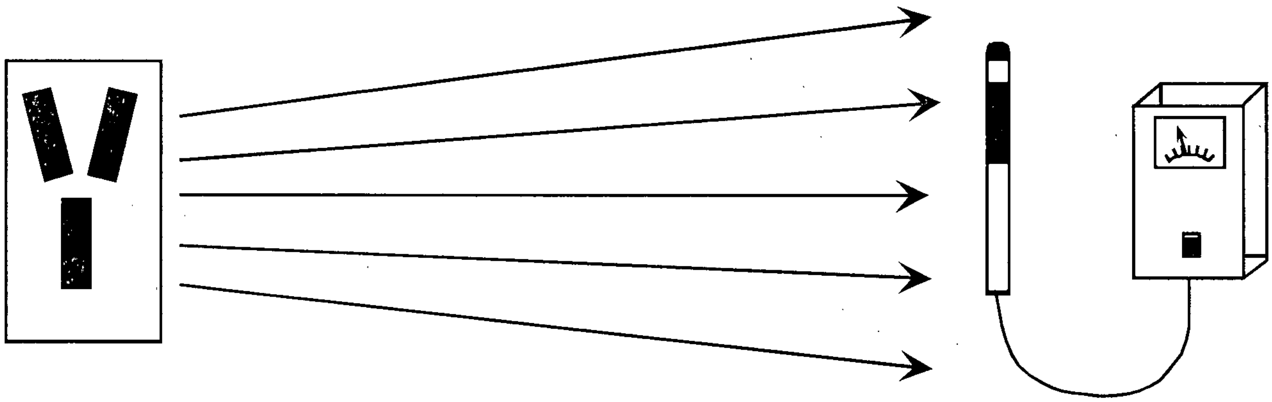
If the activation products or any other impurities plate out on reactor coolant system surfaces, the deposits are called CRUD. Prior to going into a refueling outage, some plants will add a chemical to the reactor coolant system to force the CRUD off the surfaces, and then use the cleanup system to remove the material from the coolant. This helps to reduce the radiation levels present during the refueling outage.

MATERIAL	RADIATION	HALF-LIFE
Krypton-85	Beta/Gamma	10 years
Strontium-90	Beta	28 years
Iodine-131	Beta/Gamma	8 days
Cesium-137	Beta/Gamma	30 years
Carbon-14	Beta	5770 years
Zinc-65	Beta/Gamma	245 days
Cobalt-60	Beta/Gamma	5 years
Iron-59	Beta/Gamma	45 days
Tritium (Hydrogen-3)	Beta	12 years

The list above shows some of the radioactive materials produced either by fission (fission products) or by neutron absorption (activation products). The first five isotopes on the list are fission products, and the remaining four are examples of activation products. These materials are of particular interest because of their:

- Relatively long half-life,
- Relatively large abundance in the reactor, and/or
- Ability to chemically interact in biological systems.

Not included in the list above, but of extreme importance, is the isotope nitrogen-16 (N-16). This isotope has a very short half-life (about seven seconds), but emits an extremely powerful gamma ray. N-16 is formed when an oxygen-16 atom absorbs a neutron and decays. Since every molecule of water has an oxygen atom, there is a large amount of N-16 produced in the core. N-16 is a major concern for shielding due to the high energy of the gamma ray emitted. Also, any system that contains primary coolant and exits containment must be of concern. One method of minimizing the radiation from N-16 is to allow the flow of coolant to circulate in a loop for a time period that permits the N-16 to decay, or by slowing down the flow to allow the decay (about a 1 minute delay is sufficient).



Instrument Calibration Sources

Small quantities of radioactive material (called sources) are stored on the plant site to allow instrument technicians to properly test and calibrate radiation detection instruments. These sources are completely sealed and are stored in isolated areas when not in use.

Plant calibration sources are not a major contributor to a worker's dose at a power plant.