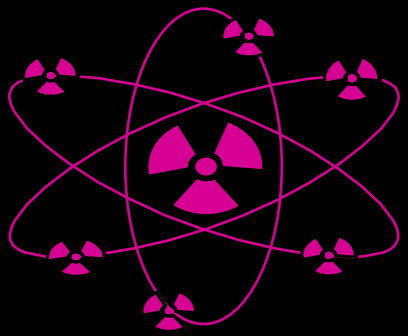
Radiation Safety



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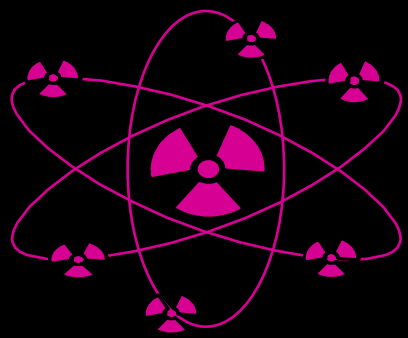

Accidents

Steve Fowler – Fowler Associates
Hans Wiegert- Sealed Air Corp


CAUTION
TURN ON
OZONE VENT
BEFORE
ENTERING PIT
CAUTION
RADIATION
NO ADMITTANCE TO PIT
WITHOUT A
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- CAUTION -
DO NOT ENTER UNLESS
GREEN LIGHT IS ON

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Is it good for us or Fungi? You be the judge:
Radiation Hormesis
Fungi and Radiation

NEW Scanner Vans Allow Drive-by-Snooping

Earth receiving increased radiation due to solar activity

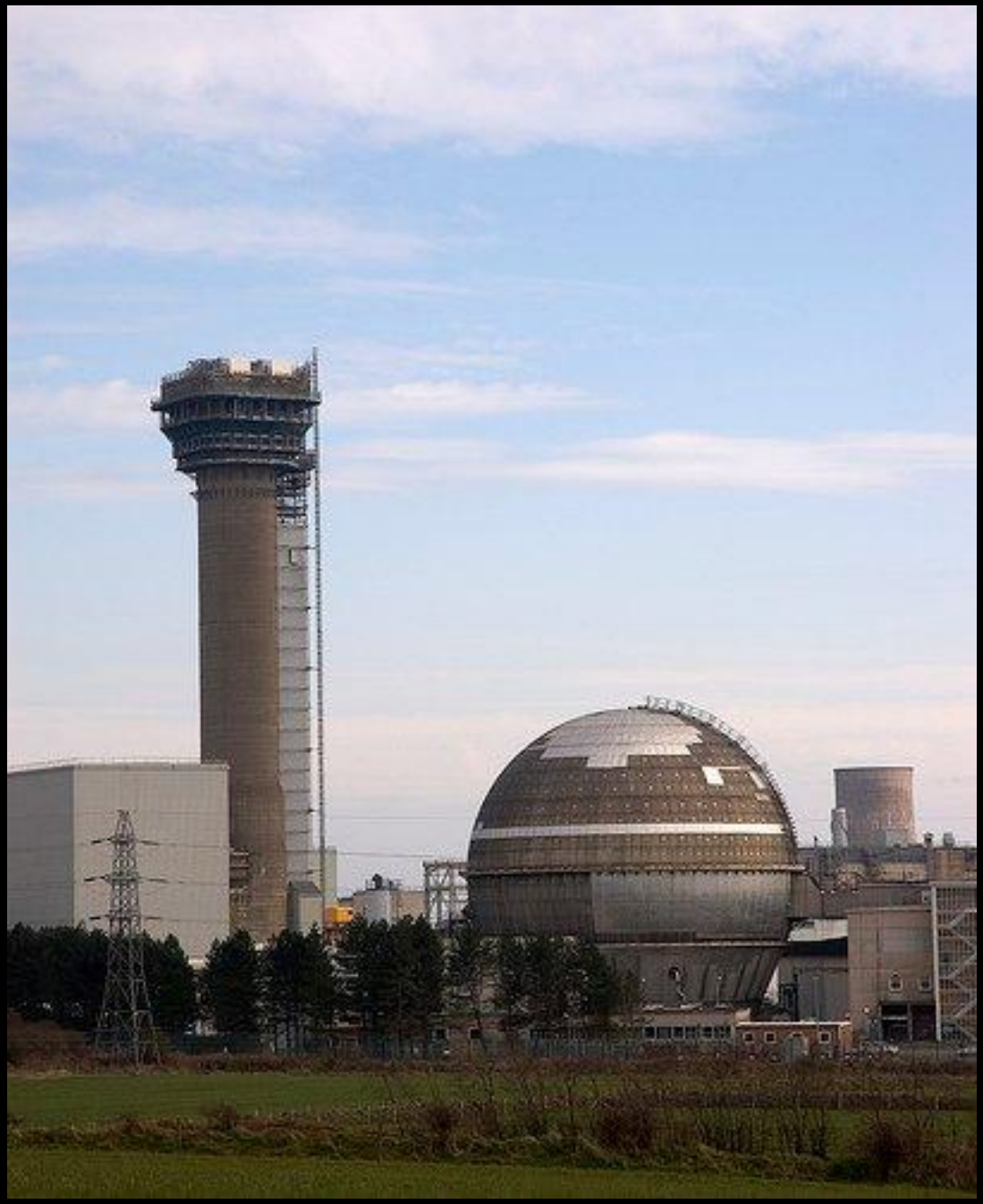
No Genetic Effects in Children of A-Bomb Survivors

Today In Radiation Safety History

by Raymond Rouse

On October 18, 1945; Top-secret documents from the Los Alamos National Laboratory reach the hands of Lavrenty Beria. Beria was second in command in the USSR and was Stalin's right hand man during the war. USSR began receiving word about a top secret weapons program called the Manhattan project. Beria was head of the Soviet secret police and later informed Stalin the nature of the program. In December 1944 Stalin put Beria in charge of the development on their atomic bomb. Beria quickly established an extensive spy network to infiltrate the Manhattan project. Soon he found Klaus Fuchs who was a Soviet sympathizer who would head up the spy network in the US. It was Fuchs who

Dr. Arthur Charlesby



On October 8, 1987; an operator at Crystal River nuclear power plant removed lead shielding at the reactor cavity entrance in order to inspect for water leakage and uncovered a high radiation field. At Crystal River operators were trained to be advanced radiation workers and could perform their own surveys.

The operator made radiation surveys prior to, and after removing the shielding, but misinterpreted a pegged instrument reading as slightly higher than maximum scale. Upon discovering that his dosimeter was reading higher than anticipated, the operator immediately notified health physics.

The post-event survey by health physics personnel showed the intensity of the radiation field to be 55 Rem/hr in the center of the opening. The operator received 1.8 Rems whole body exposure in about two minutes.

On September 30, 1999; a criticality accident occurred at the Tokaimura nuclear fuel facility. Three workers were preparing a small batch of fuel for the Joyo experimental fast breeder reactor, using uranium enriched to 18.8% U-235. It was plant's first batch of fuel for that reactor in three years, and no proper qualification and training requirements appear to

been established to prepare those workers for the job. At around 10:35, when the volume of solution in the precipitation tank reached about 40 liters, containing about 16 kg U-235, a critical mass was reached.
The accident caused heavy releases of gamma and neutron radiation. Three workers were exposed to doses of up to 1700 Rem,.

causing severe radiation sickness. The worker exposed to the highest dose died on December 21, 1999. The worker exposed to the second highest dose of 1000 Rem died on April 27, 2000. 68 other persons were irradiated at lower levels. Among them were the workers who stopped the chain reaction: they were exposed to doses of up to 12 Rem, exceeding the 10

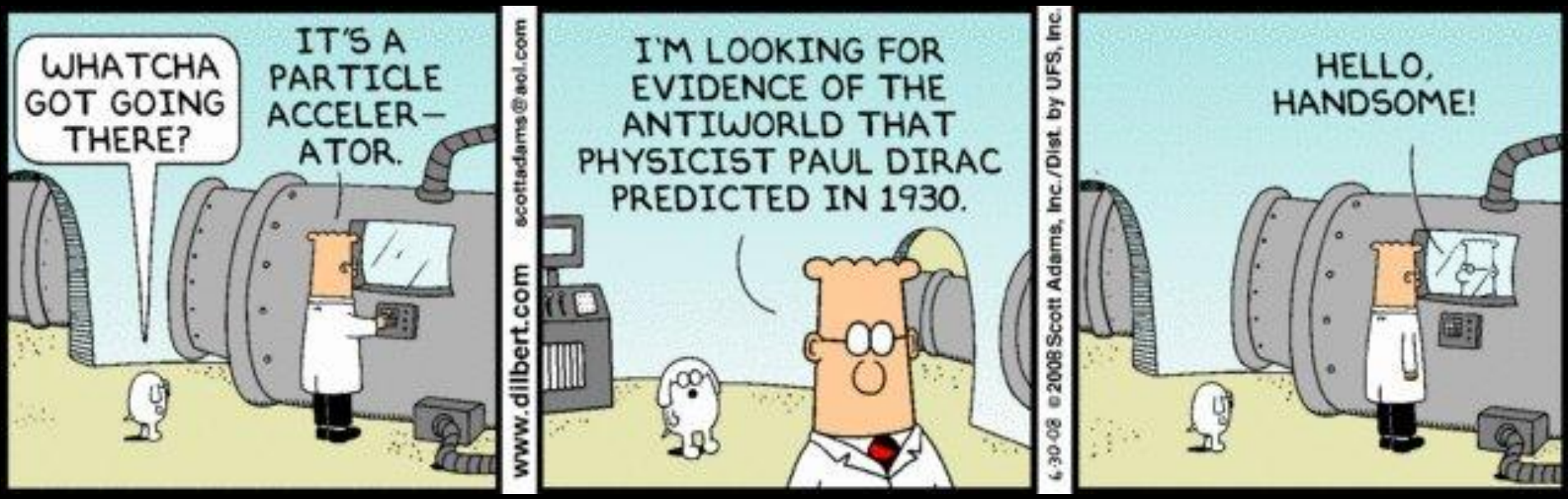
Rem limit for emergency situations. Areas around the plant had to be evacuated, exposure to 229 members of the public ranged from 100 mrem to 720 mrem. Contamination released from the event was detected up 1/2 mile away from the site

The Tokaimura accident is the third most serious accident in the history of nuclear power, after the 1986 Chernobyl accident and the 1979 Three Miles Island accident.

On September 2, 1984; an experienced technician was maintaining an industrial irradiator used for sterilizing instruments at the Institute of Energy Technology in Kjeller, Norway . He ignored two warning alarms and entered the irradiation chamber for about 30 seconds.

At first he did not realize the 65,000-Curie cobalt-60 source was exposed then entered the chamber and saw the exposed source.
He retreated out of the room and out of the building, he was found about 30 minutes later slumped over.
He complained of pains in the chest and weakness.

He was sent to the hospital where he was treated for heart attack.
The next day he explained to the medical staff what had happened.
Blood tests were performed and significant chromosomal changes were observed.
He died on September 15th from a dose estimated at 2,200 RemS.


WHATCHA GOT GOING THERE?
IT'S A PARTICLE ACCELER-ATOR.
www.dilbert.com scottadams@aol.com
I'M LOOKING FOR EVIDENCE OF THE ANTIWORLD THAT PHYSICIST PAUL DIRAC PREDICTED IN 1930.
6-30-08 © 2008 Scott Adams, Inc./Dist. by UFS, Inc.
HELLO, HANDSOME!


2
CAUTION
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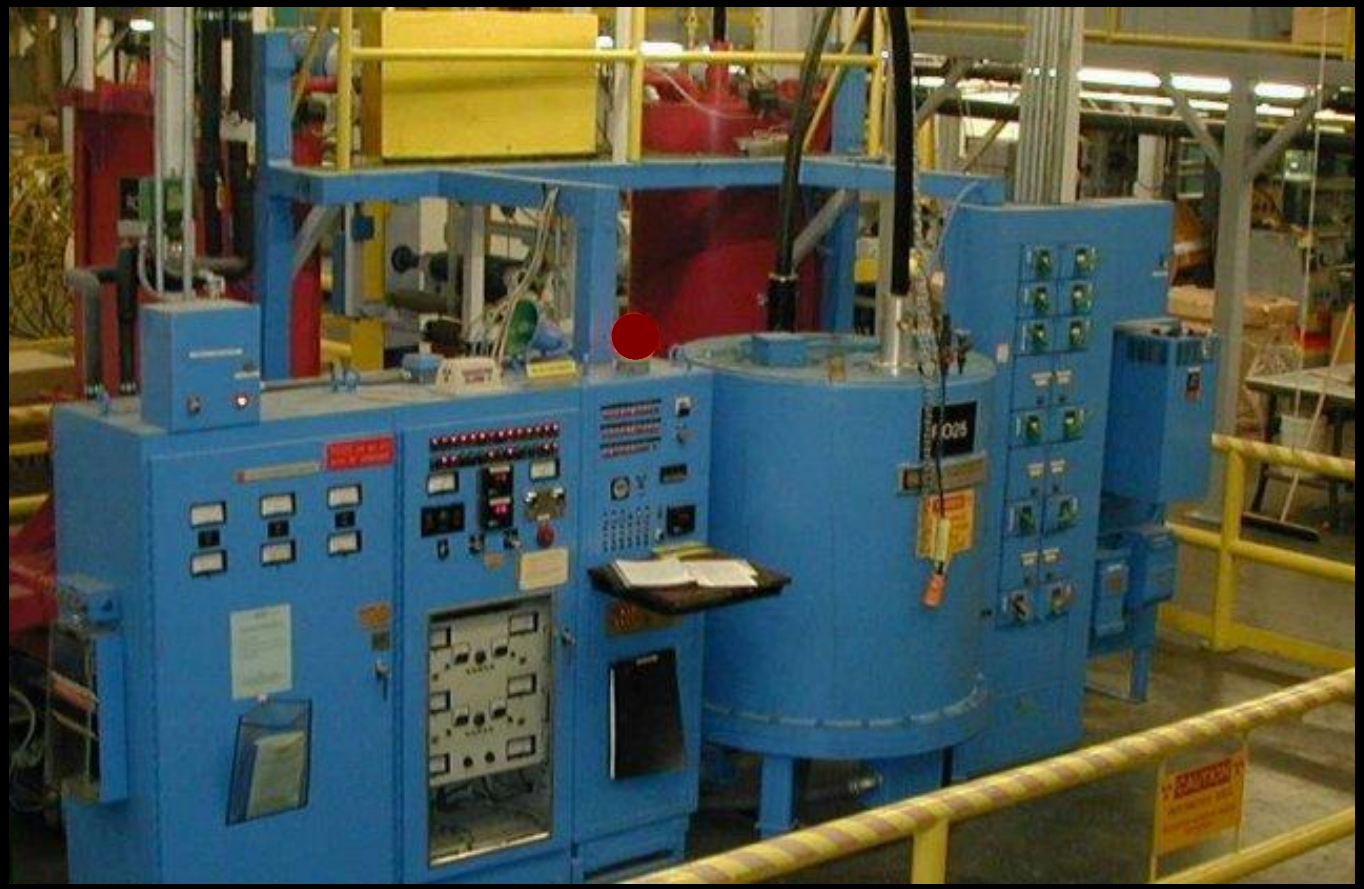
RADIATION
WHEN ENERGIZED

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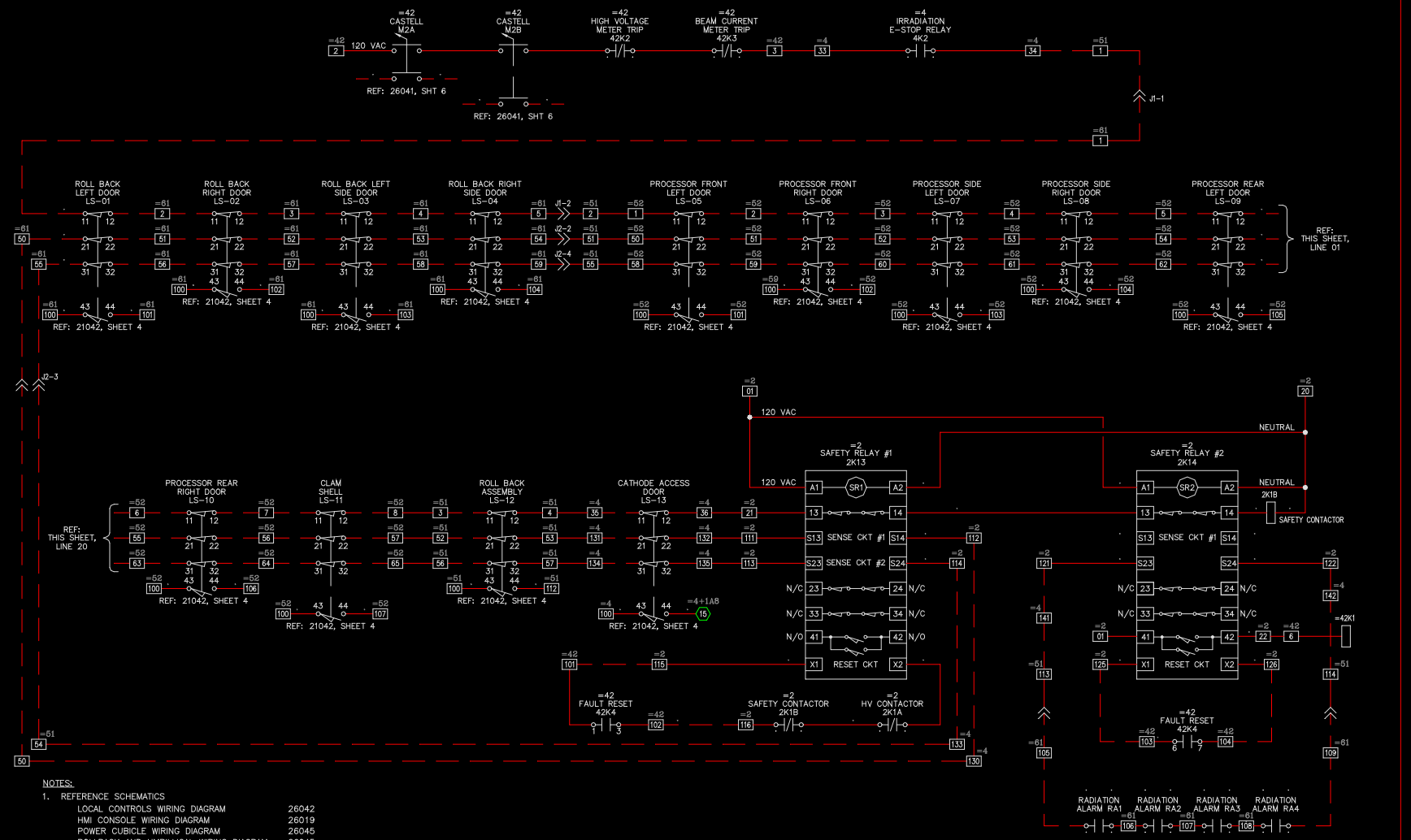

NOTES:

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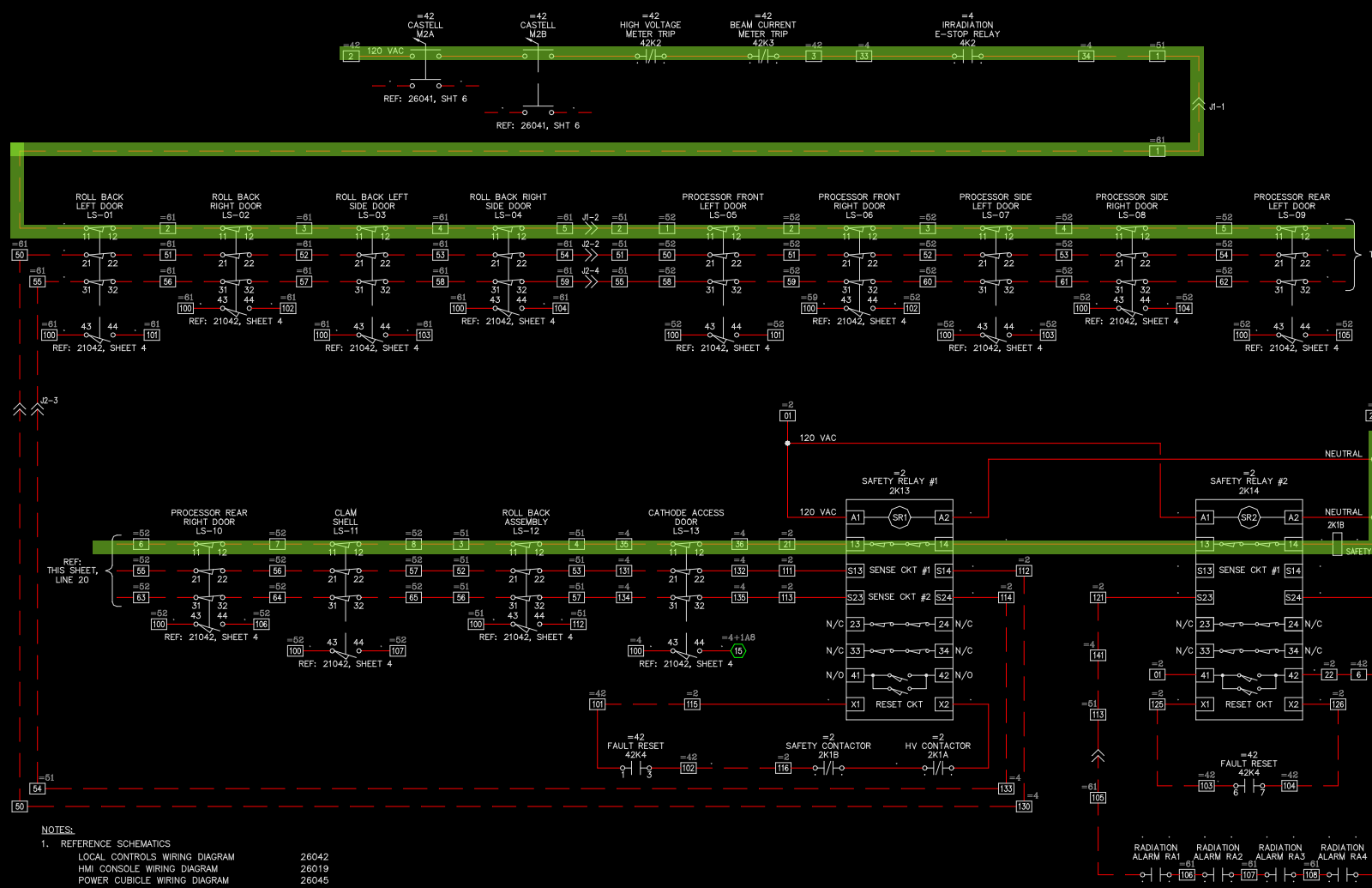
POWER CUBICLE WIRING DIAGRAM	26045
ROLLBACK AND UMBILLICAL WIRING DIAGRAM	26045



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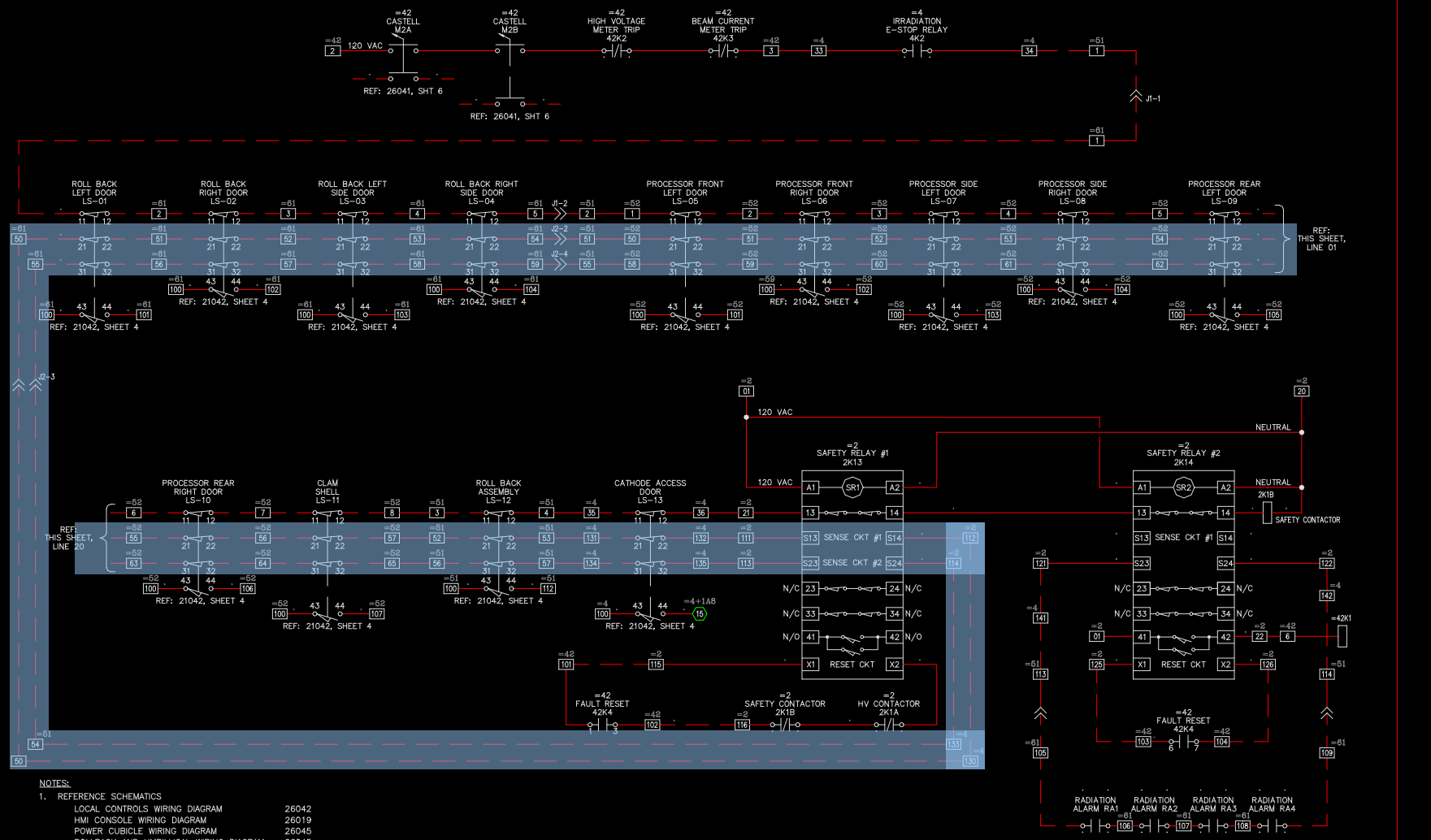

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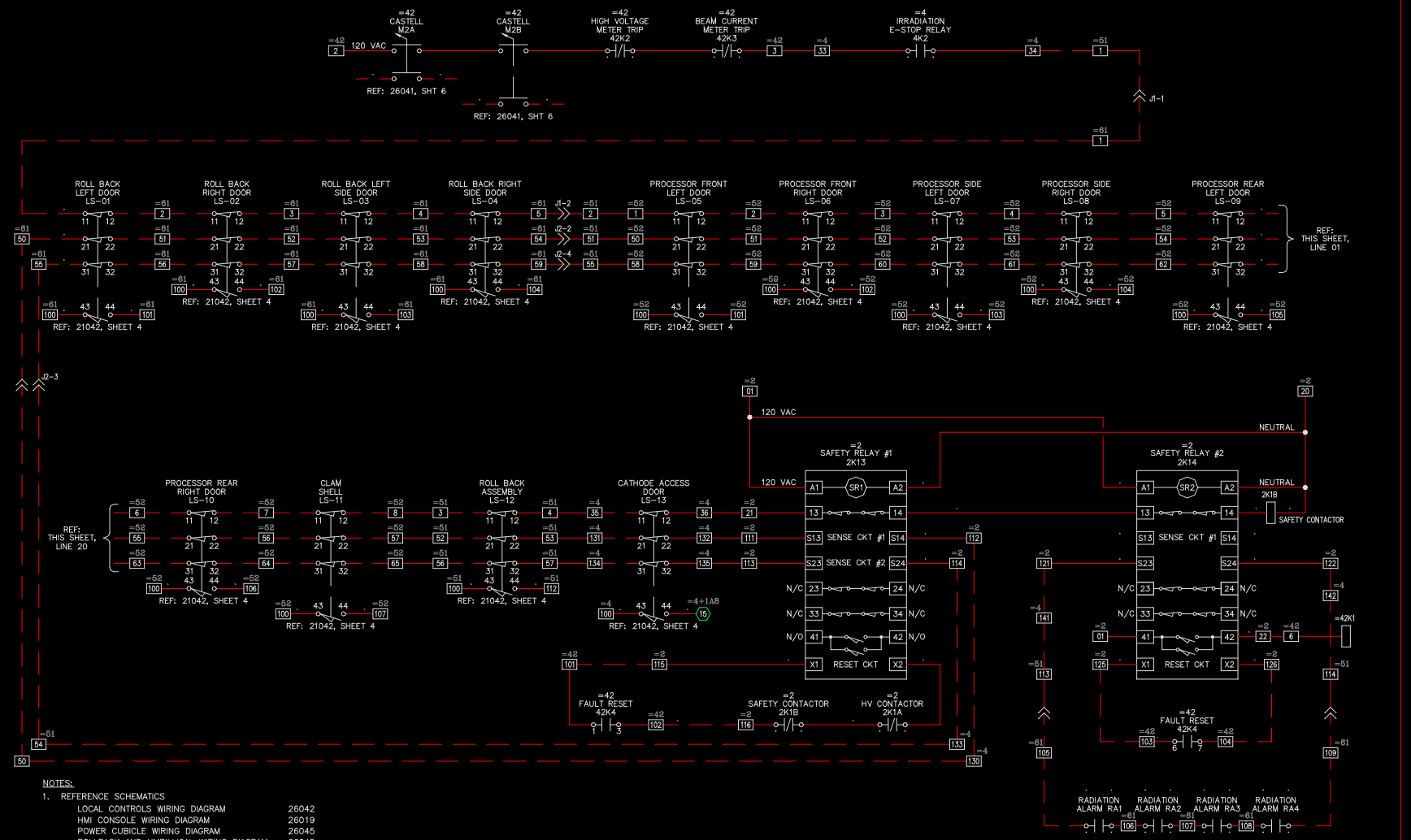

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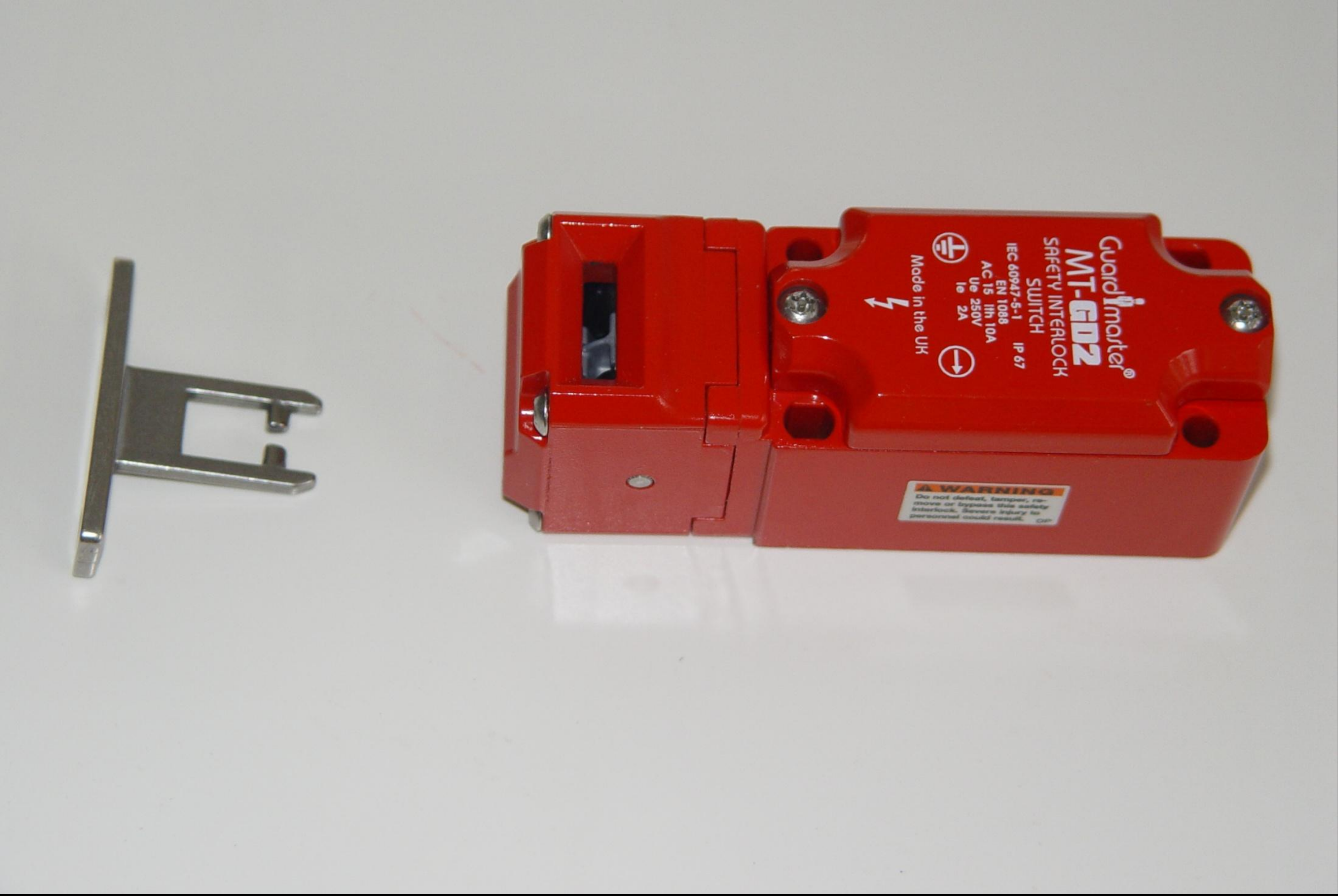
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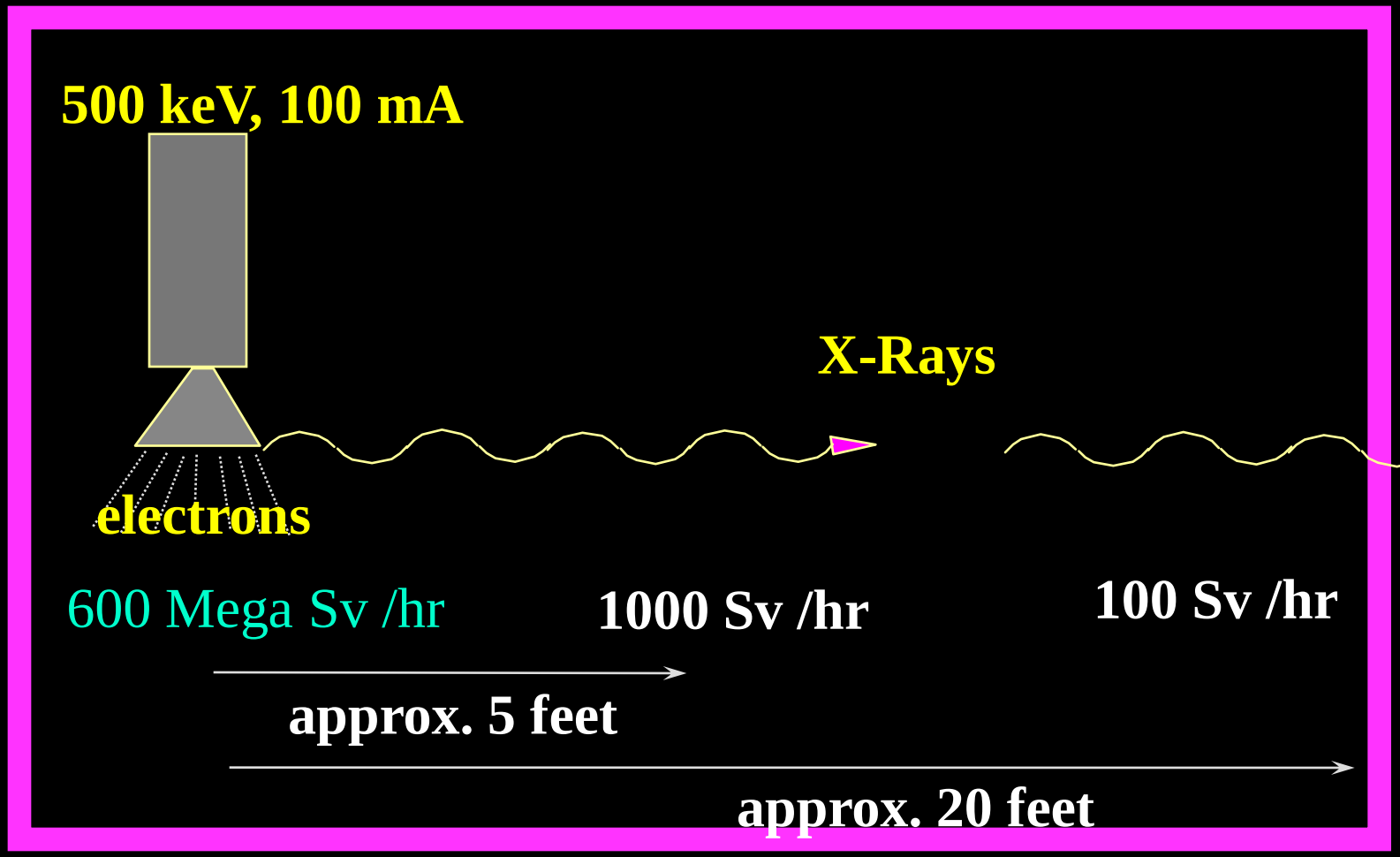


Dose Levels Inside and Outside Shielding

Massachusetts General Hospital Accelerator- 1944

7 people walked into a 1.25 MeV EBG room with the unit in electron mode

Near Misses

South Carolina -1958

Carl Lindstrom opened the door of the 1 MeV EBG shielding while it was in operation at Simpsonville

Near Misses

Canada - 1975
Operator opens tape door with high voltage on

Industrial Accelerator Accidents

Van de Graff Accelerator

France - 1991

On August 13, 1991; an accident occurred at an electron accelerator irradiator used to treat granulated polytetrafluoroethylene (Teflon). Three workers entered the irradiation room to free up a jam in the product line.

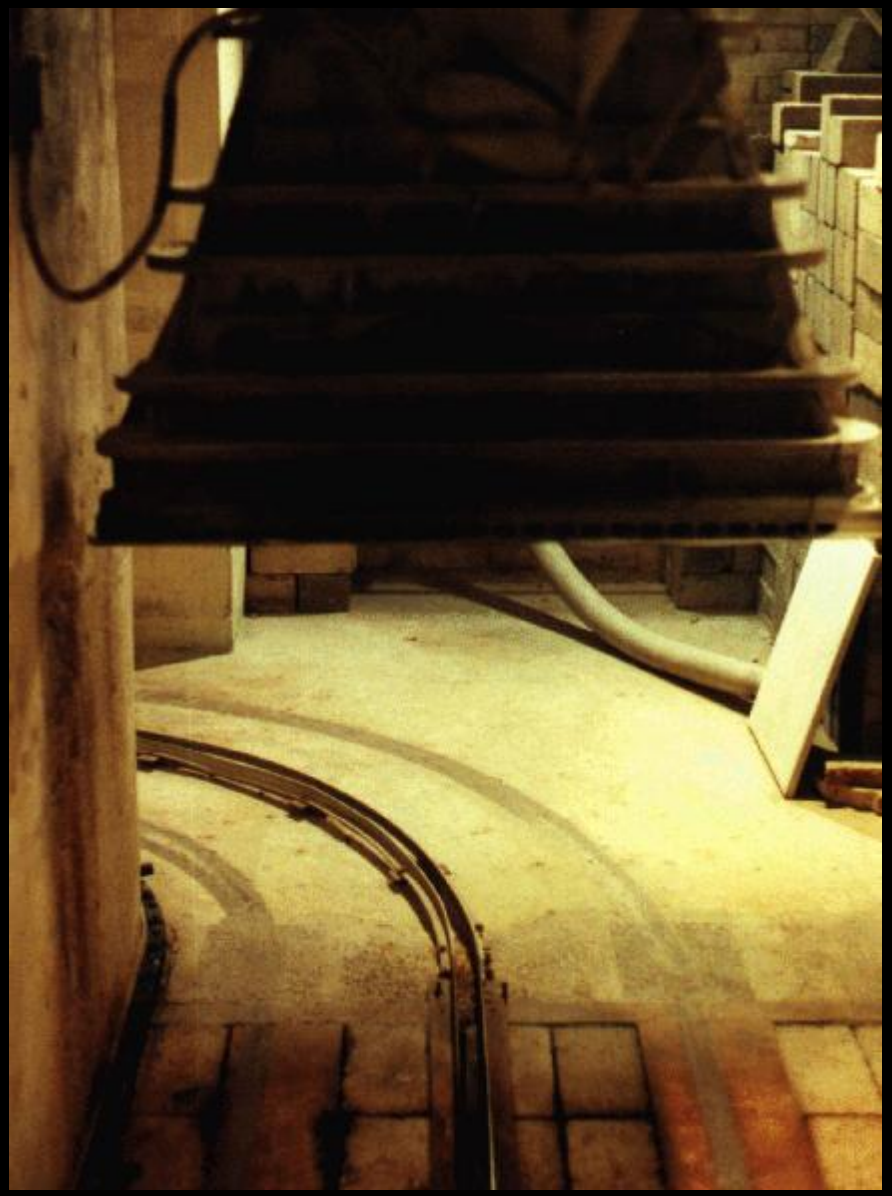
The workers by-passed safety protocols and entered the room using the exit portion of the product line and were exposed to the dark current. Dark current is produced by the accelerator when its current is turned down but accelerator voltage was still on.

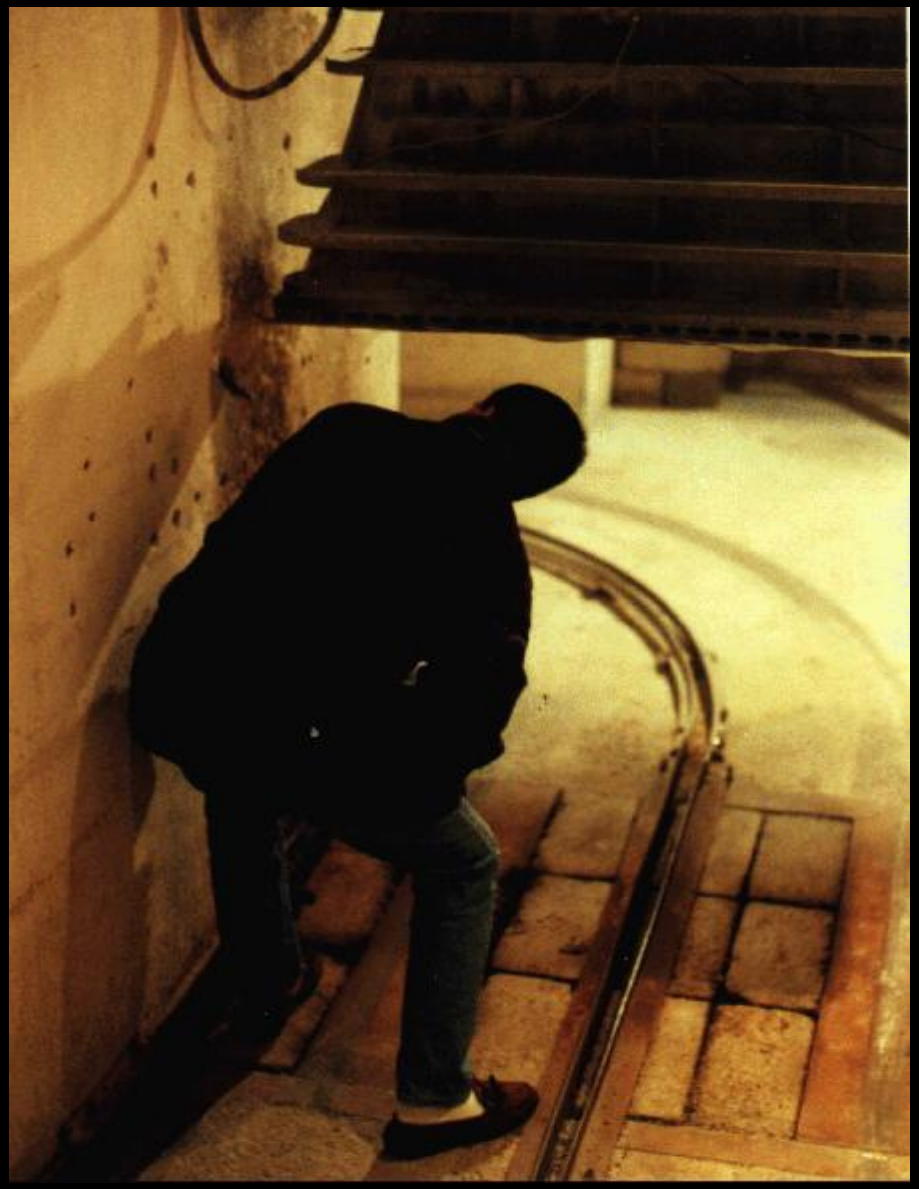
This was a decision to save time so that production could resume. Exposure rate was between 10 and several hundred Rads per second (compared to a maximum 8 mega-Rads/second when the accelerator is on).

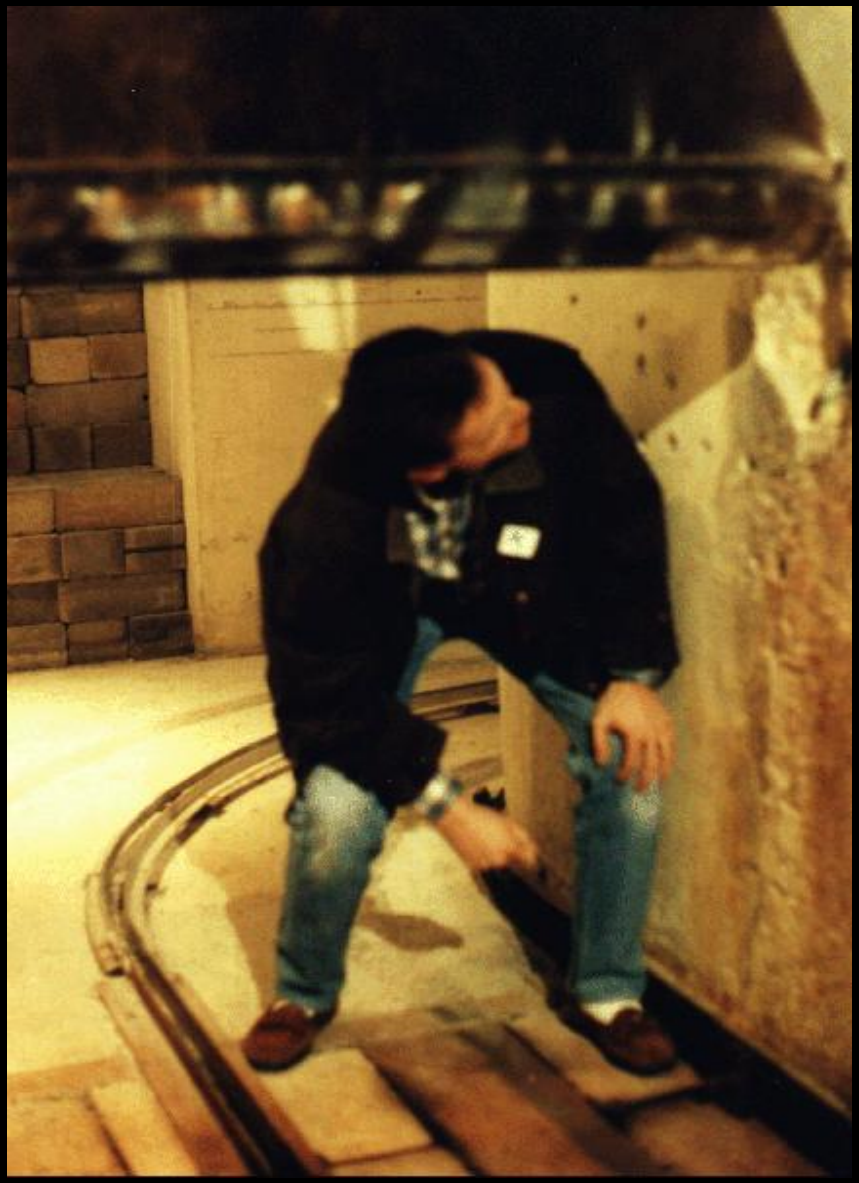
The three received localized doses, one severe enough to produce skin legions. The skin doses were estimated at 4,000 Rems (whole body dose 100 Rems in this case) for the worker with the worst injury and skin doses of 900 and 500 Rems for the other two workers.

Industrial Accelerator Accidents

Maryland - 1991





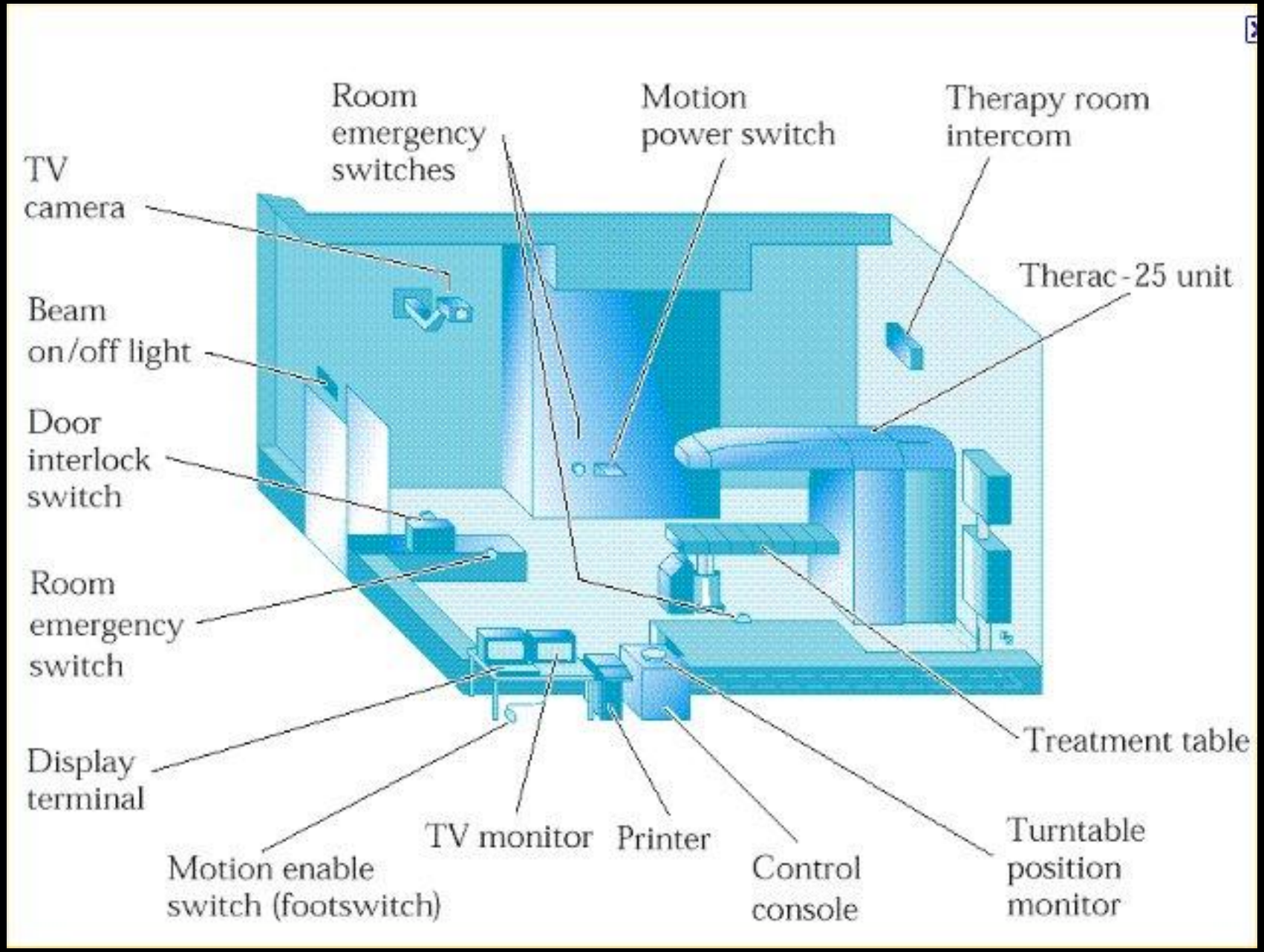


On October 4, 1967; three workers were over exposed. A failure of interlocks on an industrial accelerator-type irradiator exposed three people to doses of 125-600 REMs. The accident occurred at the Gulf Research Laboratory in Harmarville, near Pittsburgh. One worker received a 600-REMs whole body dose, plus

localized doses of 6600 Rads to the feet and legs and 8800 Rads to the hands and forearms. His hands and feet had to be amputated, but he survived largely due to a bone marrow transplant from his identical twin. Doses to the other workers were 300 Rads and 125 Rads.

All three workers were protected from infection during recovery by reverse isolation. Reverse isolation is when there is positive pressure in the room. Filtered, clean air is brought into the room and allowed to vent out of the room to the surrounding corridors. Usually visitors must wear protective garb to protect the patient from the visitors (masks, etc), if visitors are allowed at all.

Medical Mishaps


Room emergency switches
Motion power switch
Therapy room intercom
TV camera
Therac-25 unit
Beam on/off light
Door interlock switch
Room emergency switch
Treatment table
Display terminal
TV monitor
Printer
Turntable position monitor
Motion enable switch (footswitch)
Control console

On July 26, 1985; a patient received an over exposure at the Ontario Cancer Foundation in Ontario, Canada. A defect in the computer program controlling the Therac-25 radiation therapy accelerator resulted in an overexposure to a patient. A 40-year old woman being treated for cancer received a localized dose

of 13,000 to 17,000 Rads and quickly reported pain. Operators did not recognize the accident until the woman to the clinic with radiation burns on July. The patient died of the original cancer on 3 November 1985. At least 2 other patients also died

On June 23, 1970; two persons had an over exposure which resulted in two radiation injuries, at a Melbourne hospital in Australia. A faulty assembly of an X-ray unit resulted in localized overexposures to two individuals.

The X-ray device was modified around early 1969 to use different diffraction cameras. When reassembled, one shutter mechanism was reassembled incorrectly such that the shutter did not engage to cover the X-ray port as required.

the lead radiological technician and his assistant were both exposed to the beam several times during efforts to adjust a camera. On the evening of June 24th one of the workers noticed skin erythema (blistering of the skin) on his abdomen.

The two individuals were again exposed during work on the unit on June 25th, when they identified the malfunctioning shutter and realized they had been exposed, they stopped the work and notified supervision.

Their dosimetry was processed and dose to the lead technician was 2000 Rems to the skin of the abdomen and 2000 Rems to the hands, with a cumulative 90 min. exposure to the beam. Dose to the assistant for 30 min. exposure was 1500 Rems to the hands, producing skin injury, plus injury to the face.

Both of the workers recovered and returned to work.

Industrial Isotope Accidents

Argentine Cesium Source - 1968

Mexican Cobalt-60 Source - 1962

California Iridium Source - 1979

French Iridium Source - 1979

Texan Iridium Source - 1980’s

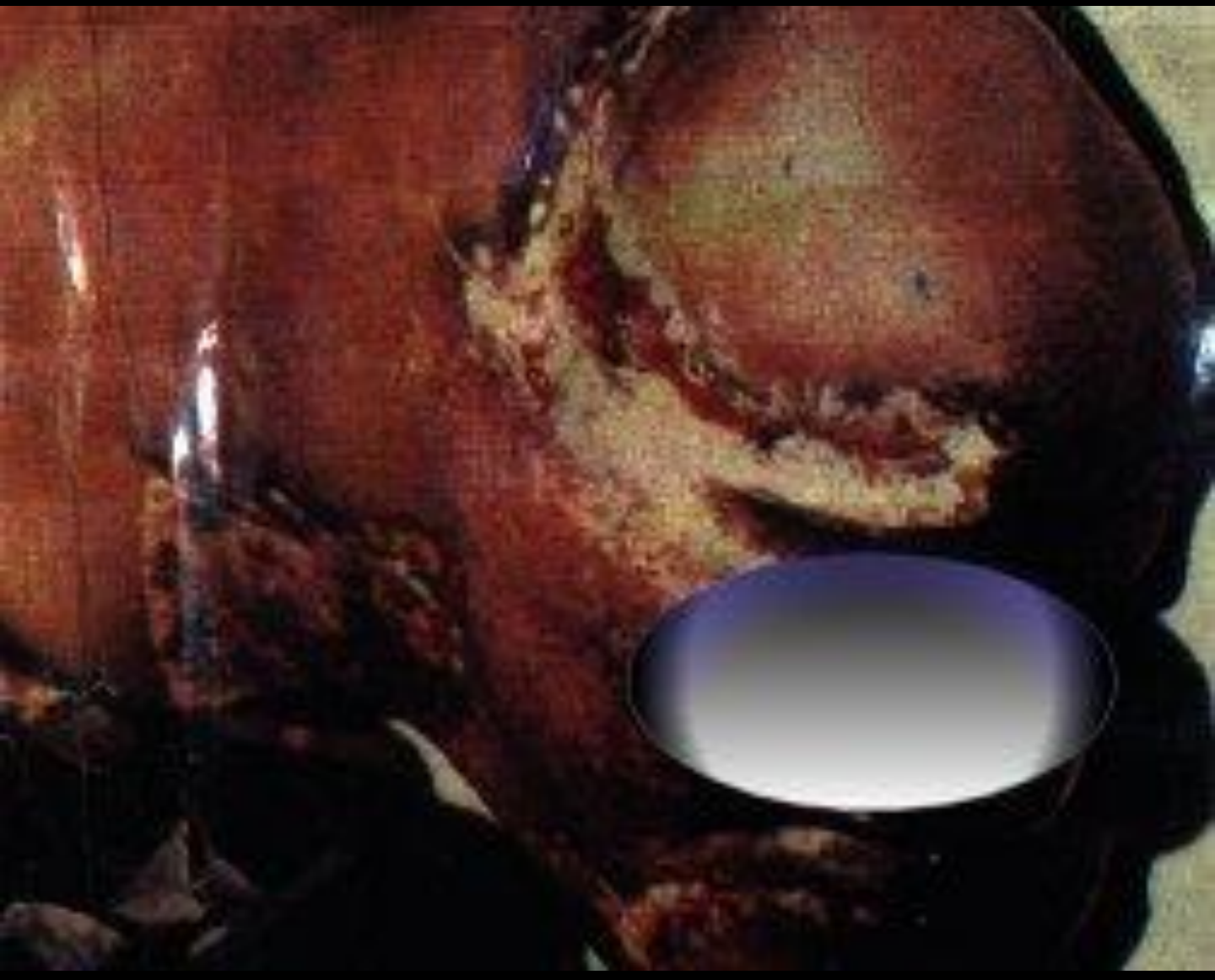
Brazilian Cesium Source - 1987

On August 16, 2000; an overexposure occurred to a radiography team in Samara Oblast, Russia. The three radiographers were using a 240-Curie Iridium-192 source to check welds in a gas pipeline. They did not notice the source became detached from the cable/shield assembly (their radiation monitor did not have batteries).

They packed the equipment (including the unshielded source) into their vehicle in which they slept overnight; the next morning all had nausea and vomiting. They returned to their base for eight days, they then discovered the loose source when preparing to return to the field.

One radiographer picked up the source to return it to the shielded container. This individual received hand burns due to localized doses of 3000-7000 Rads, and all three suffered radiation sickness from whole body doses of 250-300 Rads (for the man who slept closest to the source) to 100-200 Rads (for the other two).

Argentine Isotope Victim



On June 8, 1960; a 19-year-old research worker at a radiological laboratory in Moscow, Russia, committed suicide by exposure to a cesium-137 source. He took a capsule containing the source from the laboratory and put it in his left pants pocket for 5 hours, then shifted it around his abdomen and back for 15 hours.

His whole body dose was 1,500-2,000 Rads with 3,000 Rads to the trunk. Symptoms of radiation sickness developed within hours, he suffered extraordinary pain and he died after 15 days.

A common series of deficiencies are evident in the reported accidents and near accidents:

- Lack of management commitment
- Lack of understanding & adequate training of workers
- Lack of proper safety instrumentation
- Lack of attention or increase of complacency