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EMERGENCY MANAGEMENT ISSUES SPECIAL INTEREST GROUP

Launching Emergency Management Leadership

The 35th Anniversary of the Hanford Am-241 Accident: Lessons Learned

PNNL-SA-87302

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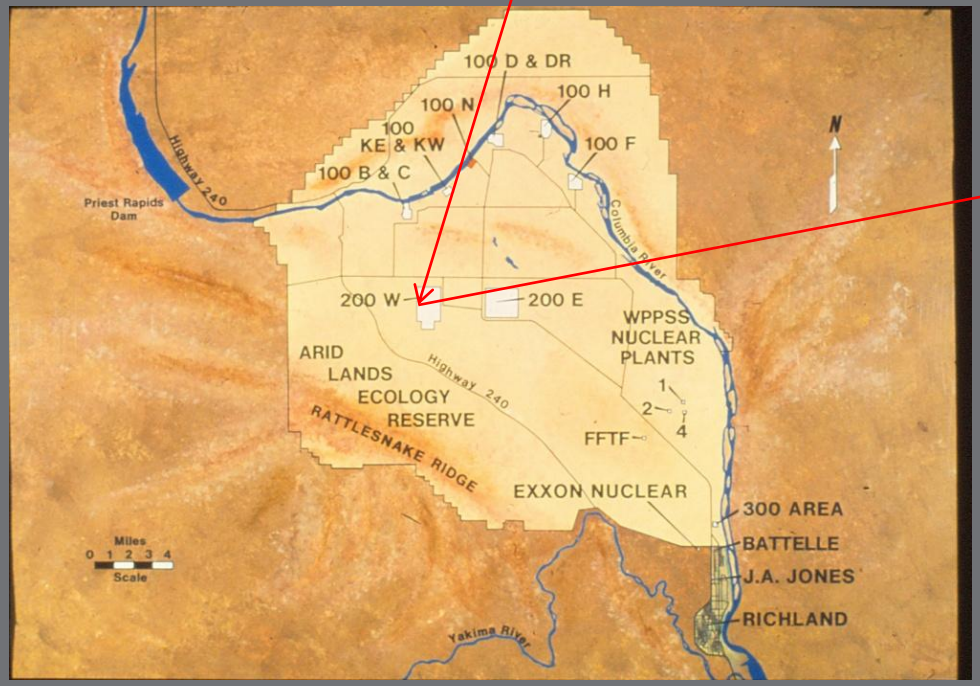
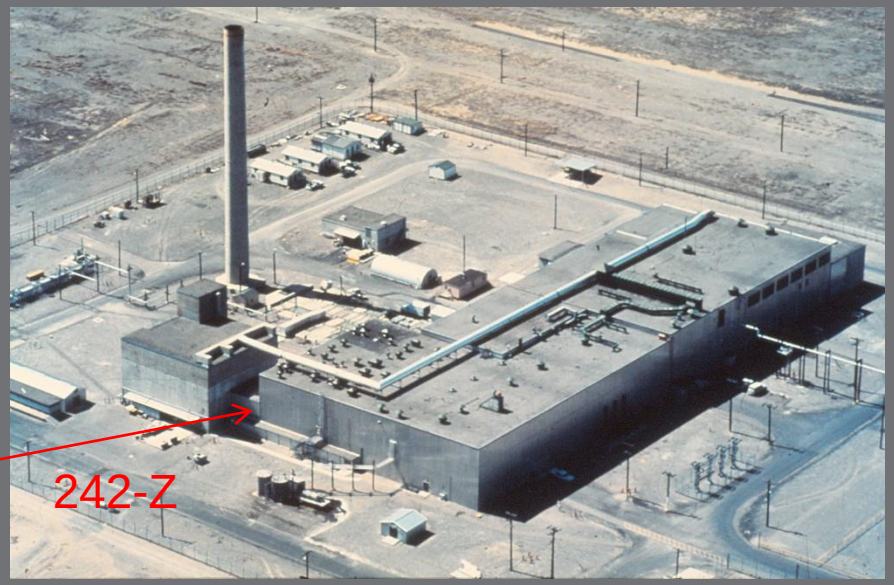
The 35th Anniversary of the Hanford ^{241}Am Accident: Lessons Learned

Abstract

The 1976 Hanford americium column explosion resulted in the highest contamination and uptake of americium ever incurred by a person. The medical treatment the patient received following the accident was highly effective and allowed him to live out a reasonably normal life. The principles of decontamination and therapy for americium uptake have not changed significantly in the 35 years since the accident, nor have there been major changes in the radiological measurement techniques or technology. There have been significant changes in facilities, medical management infrastructure, and expectations of information communication. The accident was tragic, the response heroic, and the outcome probably the best that could have been expected on all fronts.

The Accident – Aug 30, 1976 - ~3 a.m.





Plutonium Finishing Plant
Am Recovery Facility

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The Accident Description

- Chemical explosion in an ion exchange column within a glove box.
- Explosion peeled open the column, blew out leaded glass windows and glove ports.
- Struck Harold McCluskey (age 64) in right side of face, peppered with glass shrapnel, concentrated nitric acid, resin beads, and ^{241}Am.
- Chemical burns of face, eyes, neck and right shoulder.
- Lacerations with embedded foreign bodies.

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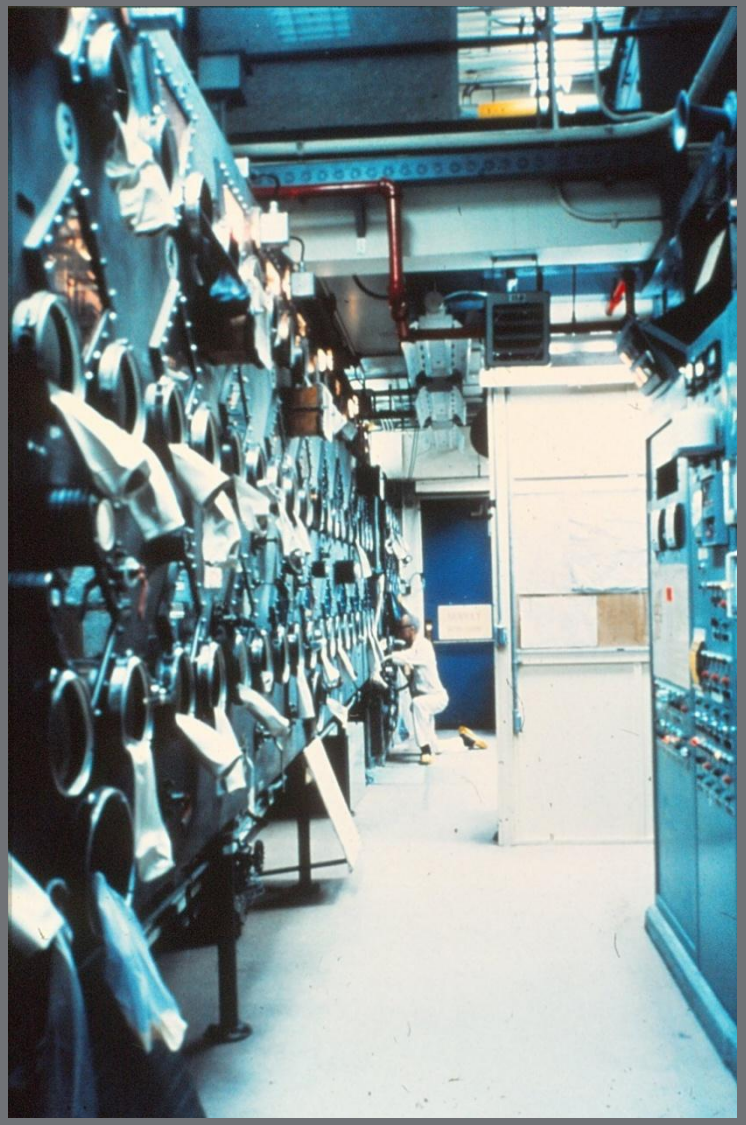

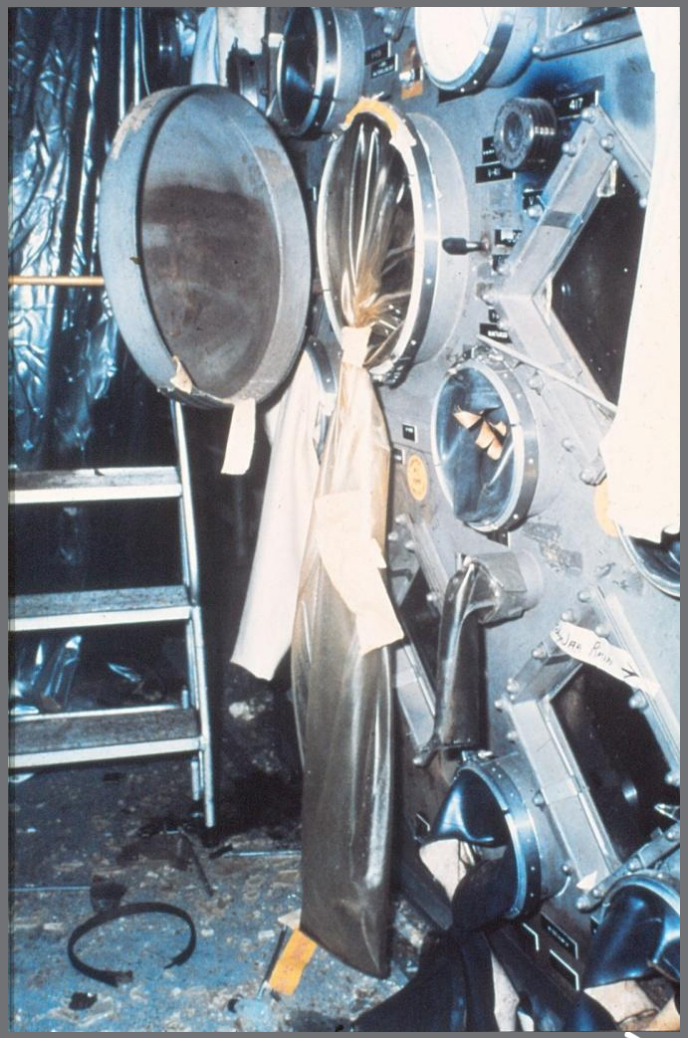

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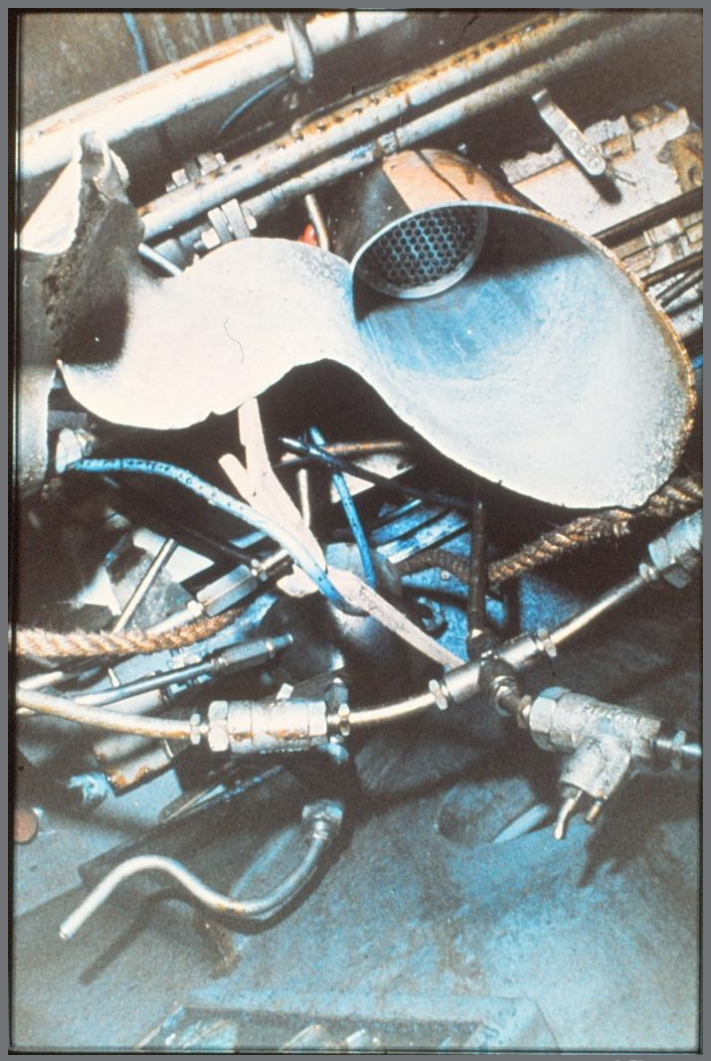

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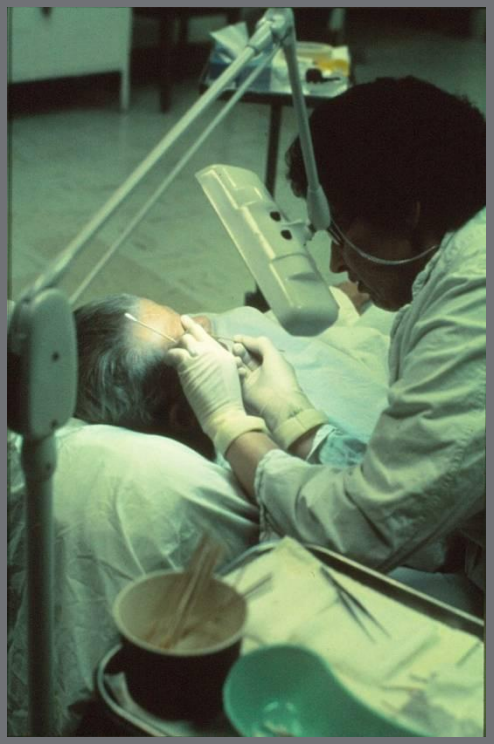
Initial Response

- Helped from room, help summoned, clothing removed and face, eyes, head, shoulders flushed with water
  - Skin contamination levels exceeded alpha survey instrument's highest scale
- Ambulance transport to the Emergency Decontamination Facility (EDF), 25 miles away in Richland
- 1 g Ca-DTPA chelation therapy upon arrival at EDF
- Showered, debridement, bathing with mild liquid detergents, vigorous scrubbing not possible due to acid burns
  - Direct alpha still off-scale, used smear wipe survey

Skin Decontamination

Shower – Bathe – Scrub - Debride

- Twice daily for 1 wk.
- Daily for 2 mo.
- Debridement for 4 mo.



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Skin Decontamination

Decontamination was extended, extensive, difficult, and never complete!

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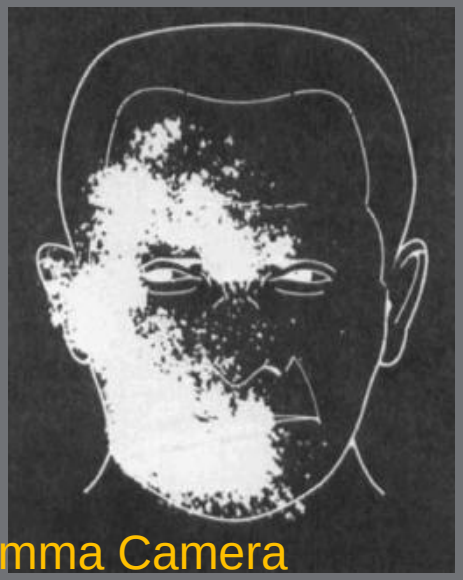
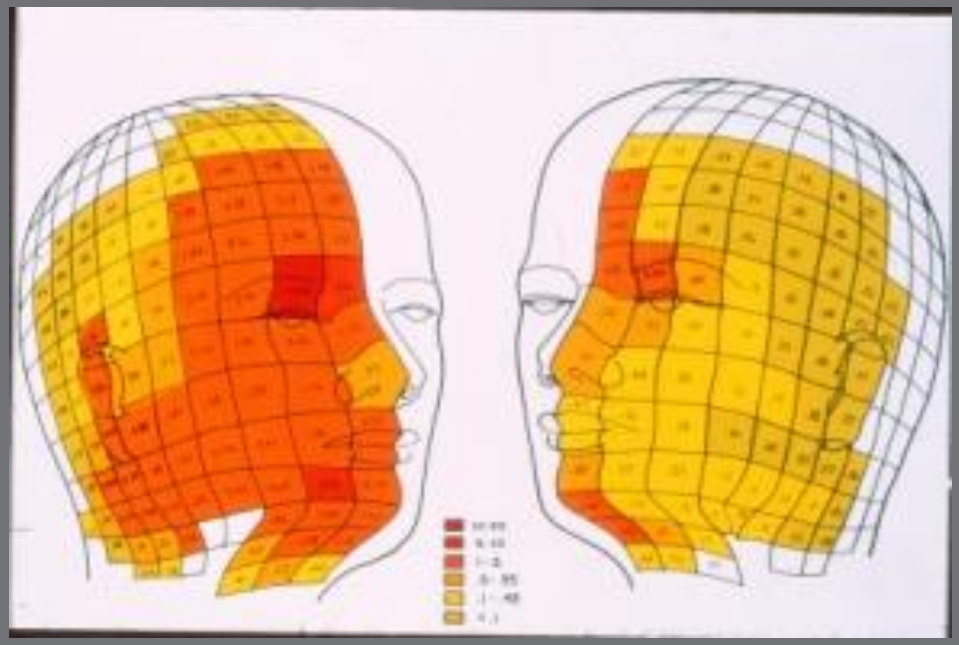
Facial Contamination Measurements



Gamma Camera



1” NaI Detector

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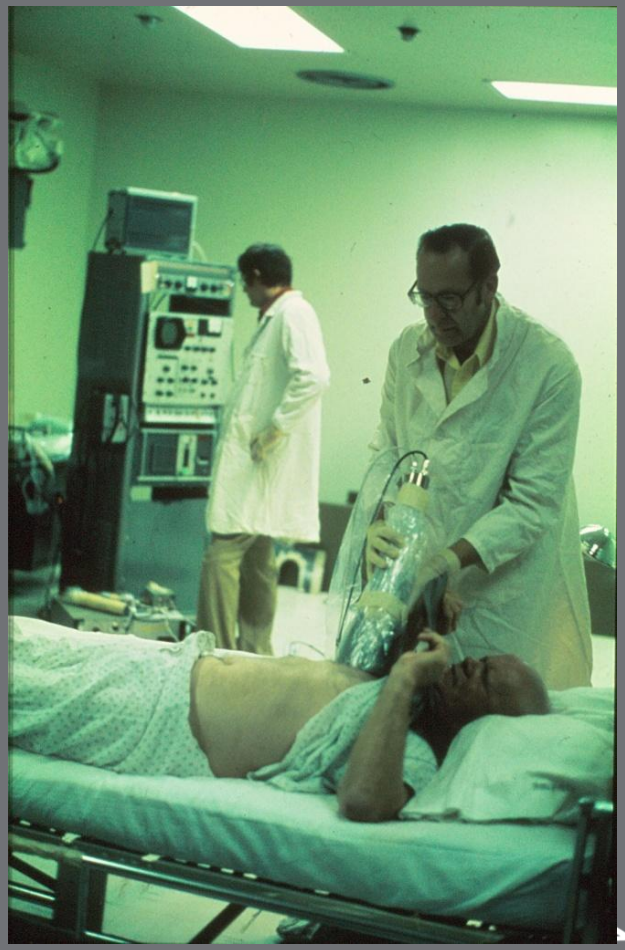
Internal Contamination Measurements

Lung and liver counting



Bone (skeleton) counting

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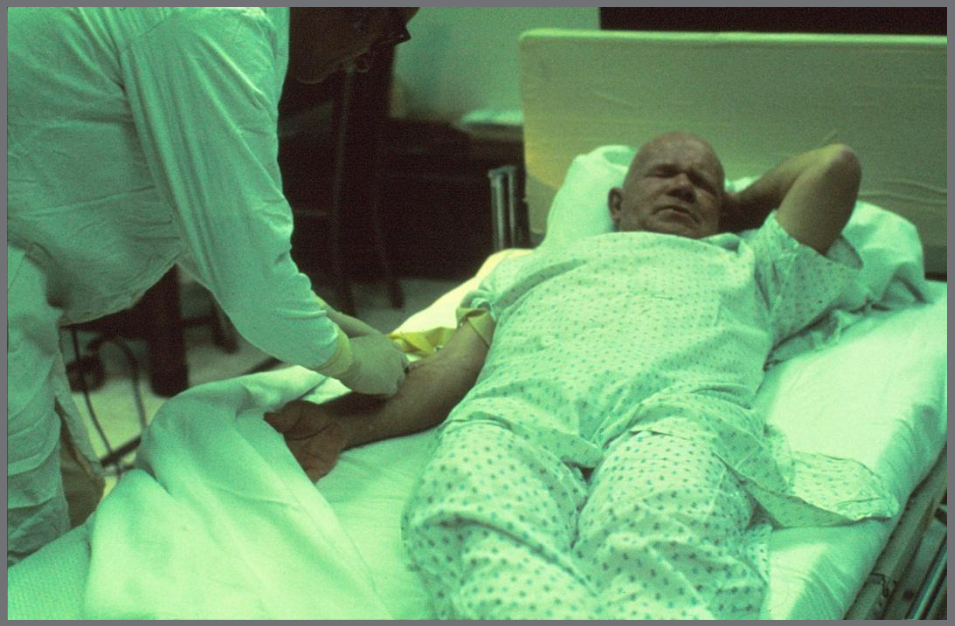
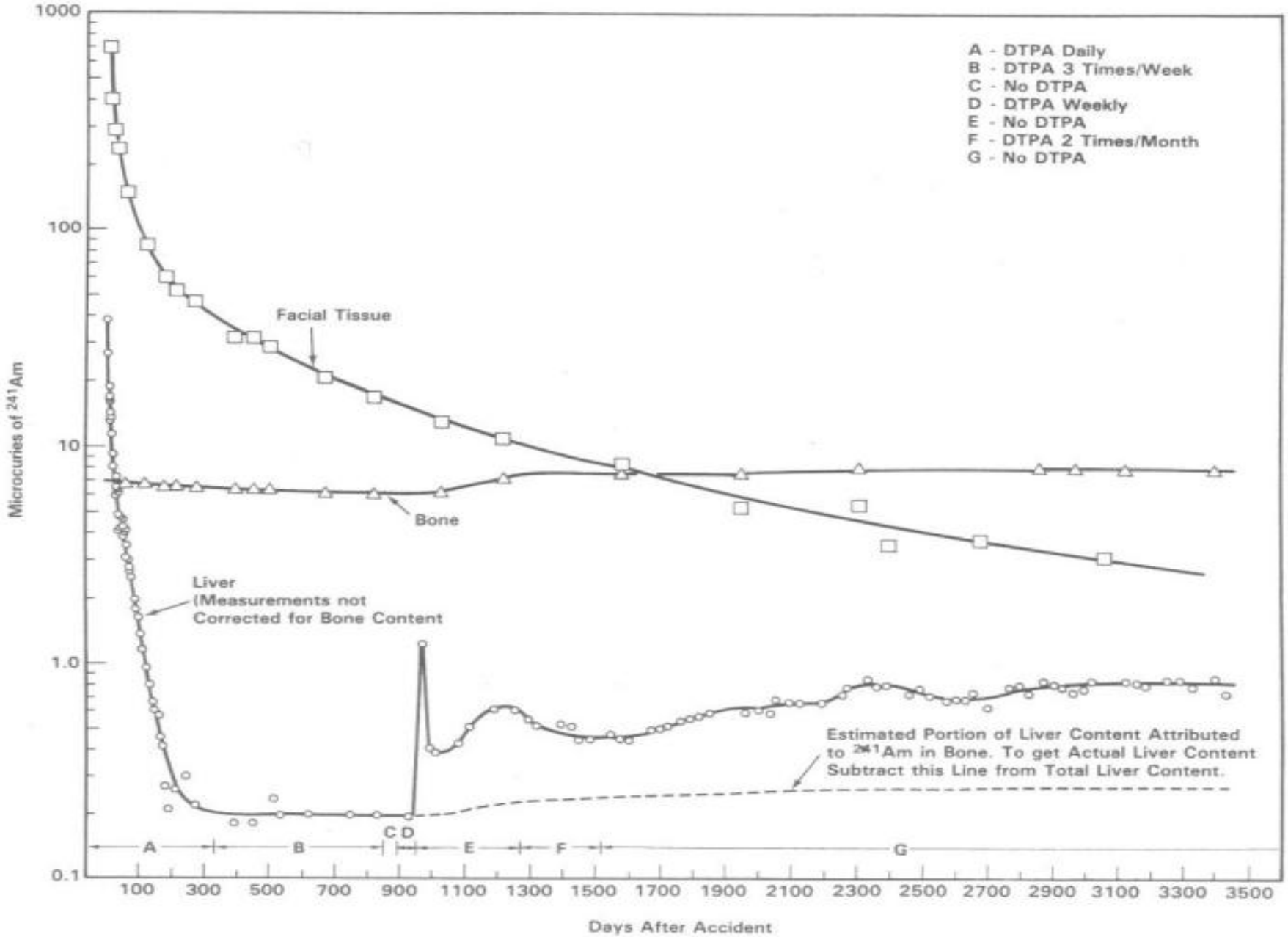
Treatment – DTPA Therapy



- Ca-DTPA with Zn supplement for first 5 days
- Zn-DTPA beginning day 5 following expedited FDA approval as IND
- 583 g DTPA by slow push iv over 4 years with no side effects
- Considered life-saving
- Approach to DTPA therapy today is basically the same

Measurement of Liver, Bone, and Facial Tissue on ^{241}Am Accident Subject Over 9.4 Year Period



Transition to Home

- Travel trailer to determine contamination problems associated with release to home.
- By late November was able to go into community and have Thanksgiving dinner with his family
- Nov/Dec – home during day. Return to trailer at night.
- January (5 months post accident) – released to home

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Long-term Follow-up

- Monthly medical checks by Hanford occupational medicine staff
- Bioassay measurements (urine, feces, liver, skeleton, facial contamination)
- Mental attitude was excellent
- Reasonably healthy for 10 years, then multiple hospitalizations
- Aug. 17, 1987 - Death from congestive heart failure due to coronary heart disease (pre-exisiting to accident).
- Autopsy
  - No evidence of malignancy.
  - Tissues analyzed for dosimetry by US Transuranium Registry

Radiation Effects

- Radiological effects relatively limited, but might have been more pronounced had exposure time been longer.
- Presence of ^{241}Am in face likely slowed healing of acid burns.
- Significant depression of lymphocytes and platelets, but no clinical symptoms manifested.
- Significant elevation of chromosome aberrations in lymphocytes, but no direct relationship with dose

Other Effects

- Vision problems from nitric acid were most significant
  - Cataracts removed from left and right eyes (547-d and 1030-d post accident) were acid-induced rather than radiation.
  - Vision compromised by acid scarring of cornea (cornea transplant).
  - Mildly progressive photophobia
- Acid scarring
- No indications of malignancy.
- Gross and histopathology tissue examinations revealed no abnormalities other than those associated with existing pre-accident cardiovascular disease.

Dosimetry

- General agreement with Am biokinetic model
- Good agreement with 1993 ICRP 67 model
- Organ dose estimates (11-year cumulative)

Organ	Absorbed Dose (rad)	Equivalent Dose (rem)
Bone	1,800	36,000
Bone Surface	51,000	1,020,000
Red Marrow	2,600	5,200
Liver	800	16,000
Lungs	160	3,200
Muscle	440	8,800
Effective	Not applicable	Not applicable

Emergency Decontamination Facility - Then

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Medical Decontamination Facility - Now

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Medical Decontamination Facility - Now

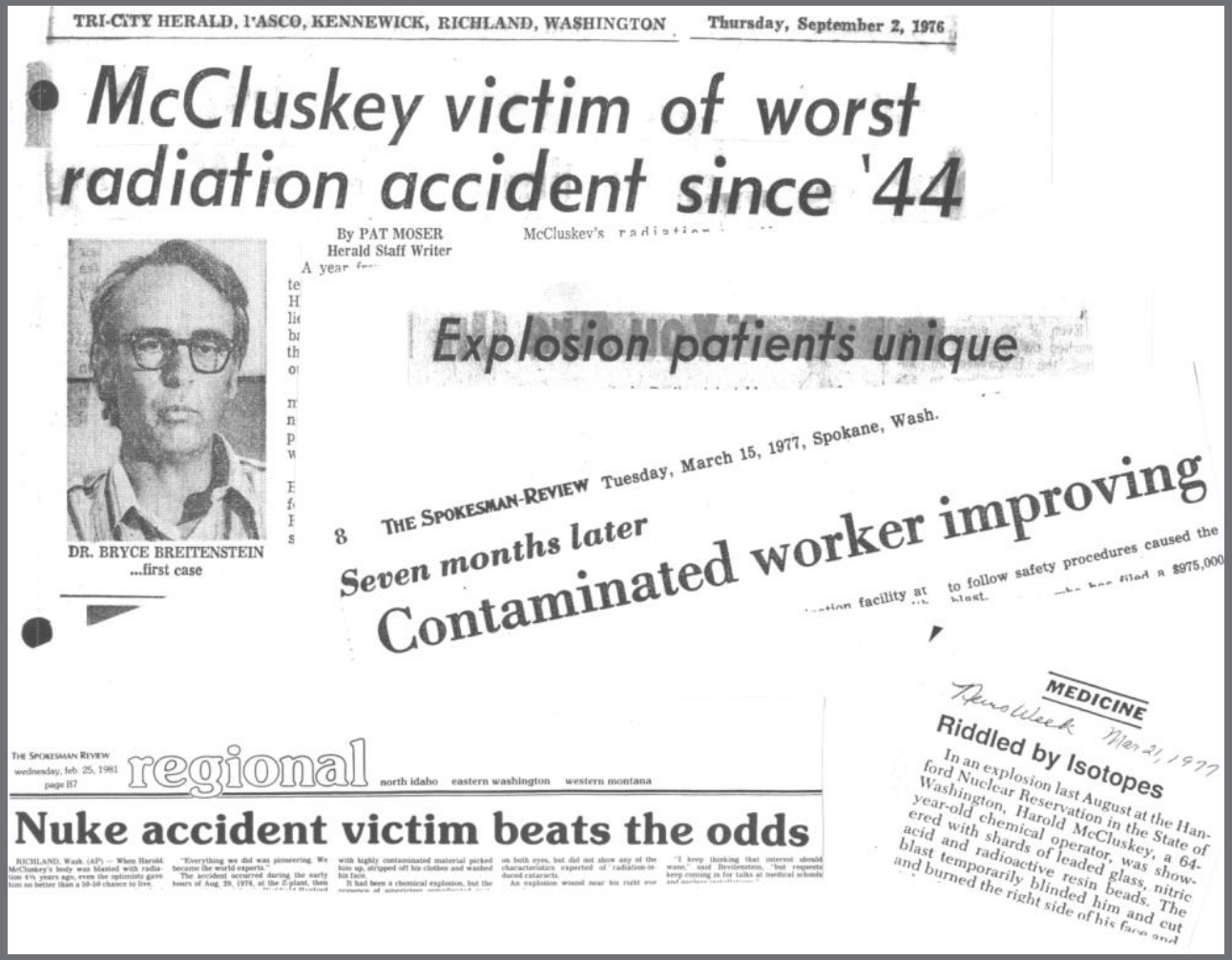
Case Management – Team approach with consensus process was highly successful

	Then	Now
Patient	Integrally involved	(same)
Lead Care	Site Medical Director	Emergency Physician Hospitalist
Supporting medical	Private practice	Site medical staff, Private practice
Nurses	Site occ med staff	Hospital
Decon Team	Site rad pro, HP, nurse	Hosptial volunteers
Rad Protection	Site HPs, techs	Hospital, Wash. State, & site staff
Consulting & Advising	HPs, radiobiologists, psychologist,	Same & REAC/TS

Media Communications- major effort

Wide public interest!

Provide accurate info and protect patient privacy



TRI-CITY HERALD, PASCO, KENNEWICK, RICHLAND, WASHINGTON Thursday, September 2, 1976

McCluskey victim of worst radiation accident since '44

By PAT MOSER
Herald Staff Writer

DR. BRYCE BREITENSTEIN
...first case

Explosion patients unique

THE SPOKESMAN-REVIEW Tuesday, March 15, 1977, Spokane, Wash.

8

Seven months later

Contaminated worker improving

THE SPOKESMAN REVIEW
wednesday, feb. 25, 1981
page B7

regional north idaho eastern washington western montana

Nuke accident victim beats the odds

MEDICINE

Riddled by Isotopes

In an explosion last August at the Hanford Nuclear Reservation in the State of Washington, Harold McCluskey, a 64-year-old chemical operator, was showered with shards of leaded glass, nitric acid and radioactive resin beads. The blast temporarily blinded him and cut and burned the right side of his face and

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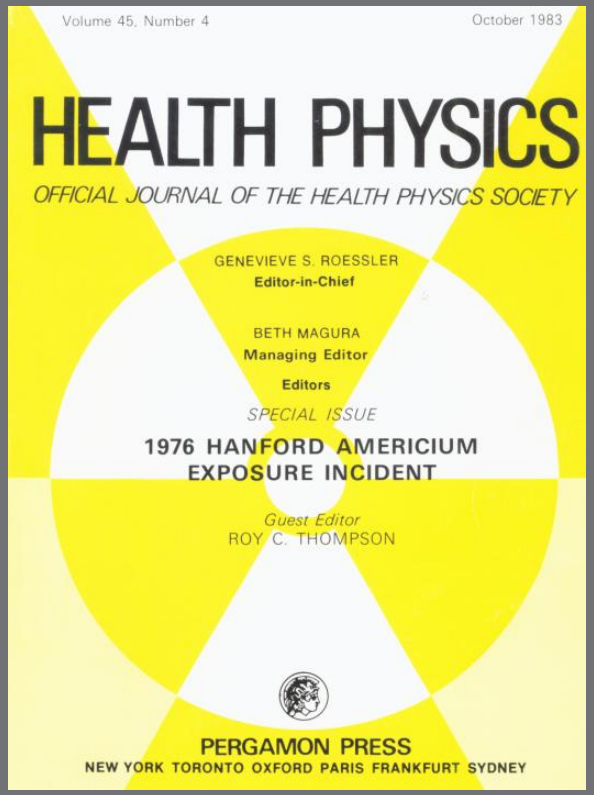
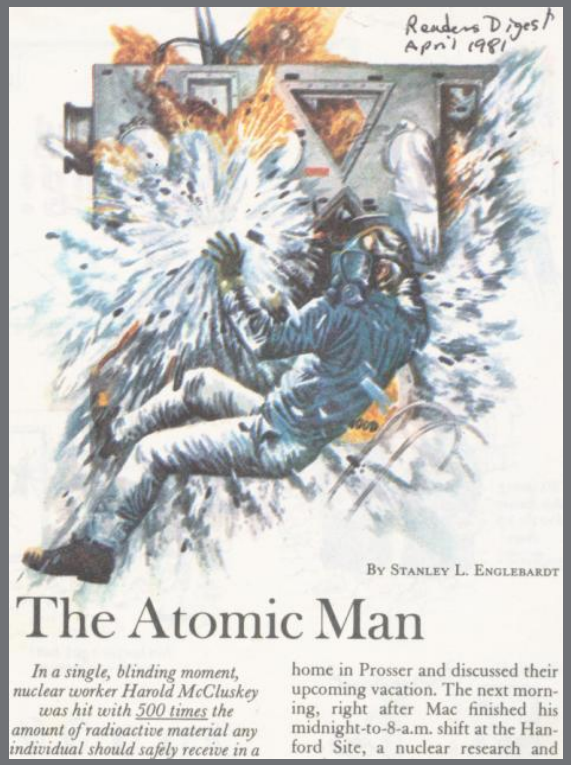
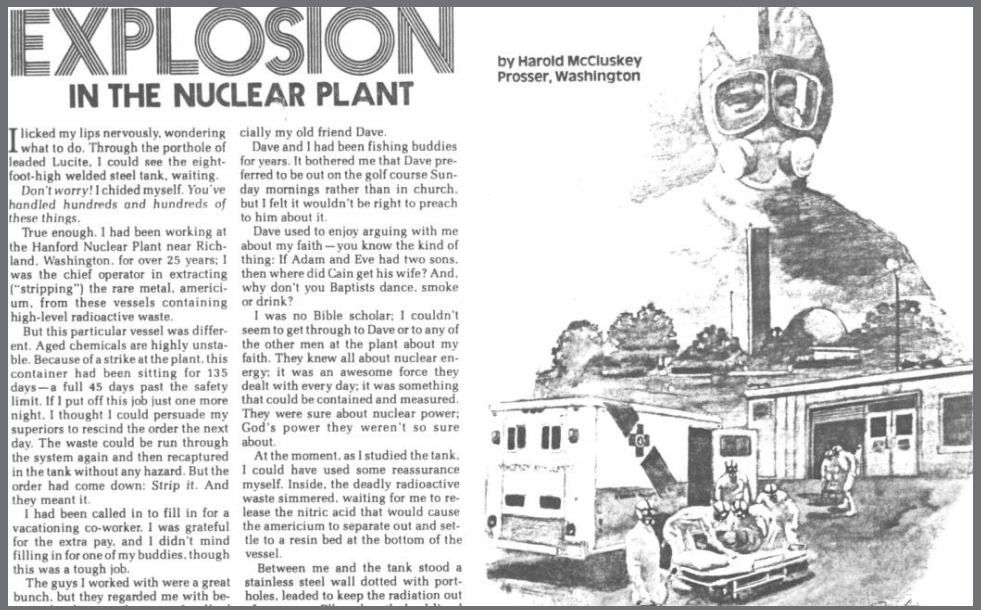
Health Physics
Oct. 1983 and
Sept. 1995





Reader's Digest
April 1981

Guideposts
Oct. 1981



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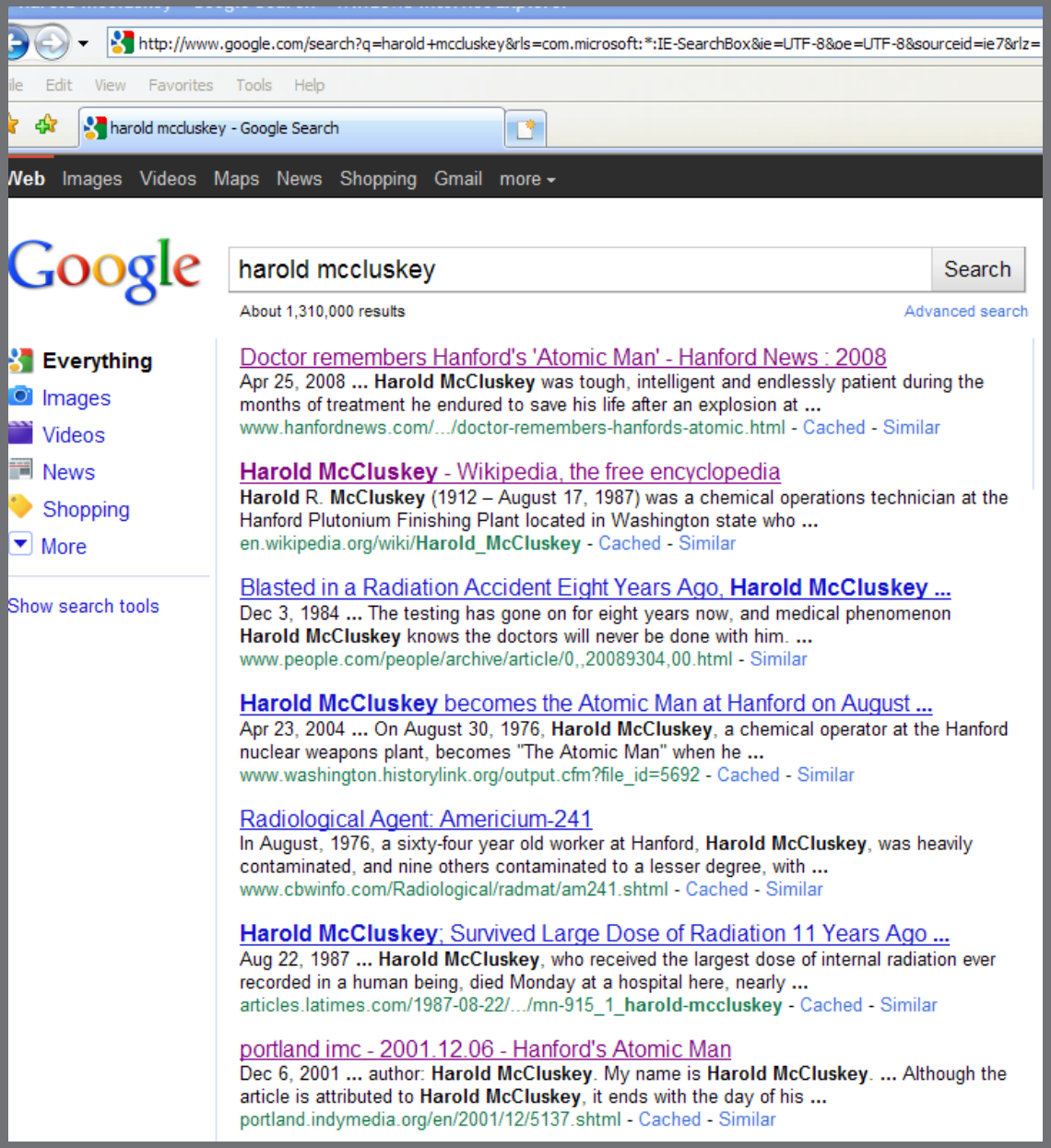

- Increased tension today
- Internet (1.3 million results in 2 seconds)
- Social media
- Instant experts
- Demand for more information sooner

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Conclusions

- Not much would be different today in decontamination, DTPA therapy, radiological measurements.
- Major change in facilities and medical management infrastructure.
- Increased expectations in communication with public
- The medical treatment administered allowed him to live a reasonably normal life.

Conclusions

- The accident was tragic.
  The response heroic.
  The outcome … probably the best that could be expected on all fronts.

- A remarkable accomplishment… and still achievable.

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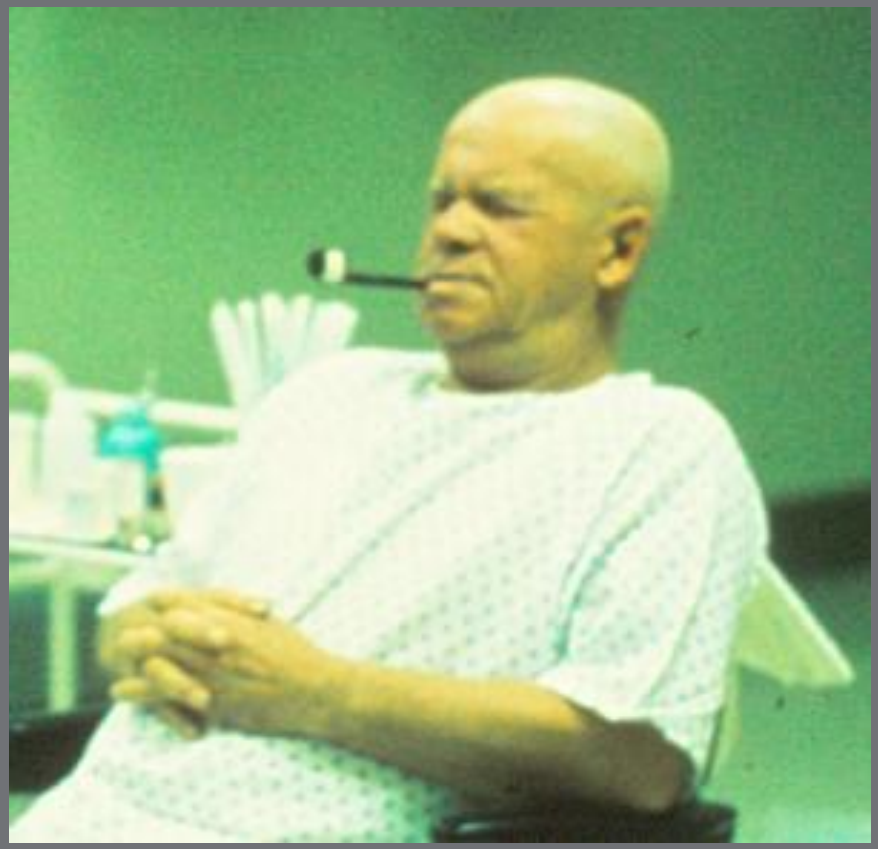
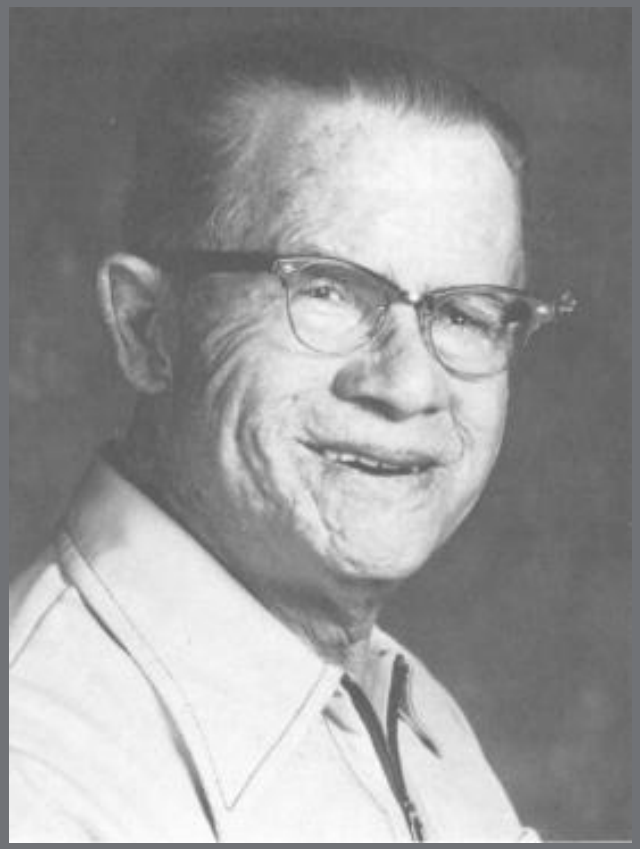
Dedication to the Ideal Patient
Harold R. McCluskey (1912 – 1987)
“The Atomic Man”





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