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THE R. W. JOHNSON COMPANY

CONSULTING ENGINEERS

P. O. BOX 803
HAZELWOOD HILL
BEN LOMOND, CA 95005
408 336-8800 • 408 336-8462 (RES)

1 May, 1979

Nuclear Regulatory Commission
1717 H St. N. W.
Washington, D. C. 20555

Attn: Mr. Joseph M. Henry, Chairman

Dear Sir:

Please tell me if one of the modifications being ordered or authorized for the TMI and similar PWR designs is the addition of interlocks or alarms, or at least indicators on the auxiliary cooling system valves that were left shut off.

If not being done, why not? This seems to be such an elementary thing to do to avoid problems of the type that occurred.

Yours very truly,

R. W. Johnson, P. E.

SEE P.2

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ACCESS TO ENERGY

A Pro-Science, Pro-Technology, Pro-Free Enterprise Monthly Newsletter

1 MAY 1979 (Vol.6, no.9) Box 2298, Boulder, Colorado 80306

The Grand Disaster: Why no casualties?

Everybody knows that the greatest "catastrophe" in the history of nuclear power resulted in zero dead, zero injured and zero diseased; but not everybody can see through the four big frauds promulgated by the media and by the politicians catering to them.

"It was a close shave; a meltdown was only narrowly averted." This is two frauds in one. First, there never was a time when a meltdown was close: it was held off by several lines of defense and would not have set in even if further malfunctions had occurred. Second, a meltdown would not have been the end of the world, either. The purpose of the containment building is to contain radioactivity *after* a meltdown has taken place, and even if it, too, fails, there would still have to be a very unusual weather situation before there could be large-scale loss of life.

The third fraud is "Scientists told us that an accident like this is virtually impossible, but now it has happened." What scientists have been saying, and continue to say, is that there is an extremely low probability of a nuclear accident *with massive loss of life*. This writer, for example, does not have to re-write a solitary line of his book *The Health Hazards of Not Going Nuclear*, and does not hesitate to recommend it to those who wish to understand why the zero death toll at Harrisburg was not merely "lucky."* Politicians who now pretend to have been duped into thinking that a nuclear accident, especially one with no loss of life, was impossible, not only falsely claim that they were told engineers are infallible and mechanical failures unheard of, but in effect they now pompously proclaim that they were dumb enough to believe it.

The fourth fraud is that "The much touted safeguards failed on Three Mile Island." They did not. Nuclear safety is not based on this or that gadget, but on two principles by which to contain any unforeseen events that might occur. One is the defense in depth, a multi-layered system of defense belts around the only danger point, the reactor core.

The two major bulwarks of this defense are the Emergency Core Cooling System and the containment building. Both were the main targets of the anti-nuclear obstructionists, and both performed superbly. Every honest scientist and every informed citizen will be *reassured* by a defense system that stood up to a freakish series of five independent, horrible failures and human errors under the most aggravating conditions.

The second principle of nuclear safety is the slowness of a nuclear accident. Had more defense lines been penetrated (or had they, as before, been disabled by error), more countermeasures, up to and including evacuation, could have been taken. A meltdown, which is *not* the last line of defense, takes many hours and gives plenty of advance warning. Alas, it was this very advantage of slow evolution (6 days) that enabled the cannibals to fan the hysteria to fever pitch.

Worse than the frauds, perhaps, was a stupendous omission. 845 MW is a lot of power, and when much energy is pent up, it is always dangerous. But nobody compared the dangers. A dam break can kill 100,000 people in a matter of minutes. Where is the first, second, and seventeenth dam when the first fails? What kind of emergency cooling do the LNG tankers docking 3 miles from downtown Boston have? Where are the evacuation plans when a gasoline refinery blows up?

No one died at Harrisburg, and no one ever came close to it.

But generating electric power by fossil fuels kills some 20,000 Americans a year by air pollution, transportation and industrial diseases. There will now be a few more dead, injured and diseased added to that toll because TMI Unit 2 no longer delivers the power that is safer. And already the media, and the politicos who cater to them, are calling for that toll to increase by slowing, or even stopping, nuclear power.

Predictably, those who opposed the safest form of power on the grounds of safety oppose it even more now that its safety has been vindicated in battle.

But the big battle is yet to be joined: Will human intelligence, will human decency, survive the concerted onslaught of the brainwashers?

HOW A PWR WORKS

A Pressurized Water Reactor is a pressure cooker in which the nuclear fuel heats water to above the boiling point, but keeps it liquid; the water is pumped to a heat exchanger which generates the steam for the turbines (see figure overleaf). The nuclear chain reaction can be instantly terminated by inserting the control rods into the core to interrupt the flow of neutrons. However, the fission products in the fuel rods will continue to generate heat at about 1 to 2% of the capacity heat. It is this residual heat that is ultimately responsible for the only danger in reactors of all types if it is not carried away by the cooling water.

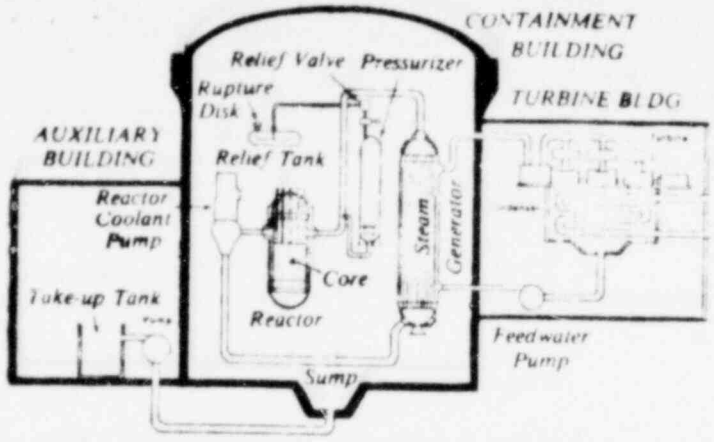
Should the water leak out from the reactor vessel, there are several provisions to replace it, most important of which is the Emergency Core Cooling System (ECCS) which will inject water under high pressure with independent pumps from an independent power supply (not shown on diagram).

If the ECCS fails, and the core remains uncovered for a prolonged period, the fuel may eventually melt, may melt the fuel assembly, and may slowly melt through the steel reactor vessel (8-10 ins. thick), and through the concrete floor into the ground, where it would solidify (up to 100 ft below the surface) when the molten goo produces less heat than is transferred to the ground. In the event of such a meltdown, the containment dome, a massive structure of 7 to 10 ft thick, heavily reinforced concrete, is intended to contain the radioactive gases and volatile particles.

It is extremely unlikely that they could get out of the containment building, but even if they did, there would have to be an inversion keeping them close to the ground, and a gentle wind blowing them into a populated center before there would be massive loss of life.

HOW IT HAPPENED

What happened at Three Mile Island (3MI) is this:



WHY NO INTERLOCK OR ALARMS ON THESE VALVES?

At 4 a.m., on March 28, when the 845 MW reactor was running at 98% capacity, there was a malfunction in the feedwater flow on the turbine side. Both auxiliary pumps tried to take over automatically, but (in violation of NRC regulations) the valves had been left shut so no water could get through. The turbines tripped (went out of service) automatically and normally. On the reactor side, the loss of the heat sink in the steam generator resulted in an increase in temperature and pressure, which generated a reactor trip signal; the reactor "scram" (instant interruption of the chain reaction by full insertion of the control rods) occurred automatically and normally.

Increased pressure should be handled by the pressurizer's steam cushion and relief valve (just as in a household pressure cooker). It was, and the relief valve worked normally, but it stuck and failed to close — a second failure, and one that caused much further trouble.

The steam escaping from the relief valve goes into the relief tank where it is quenched in cold water. But when the relief valve stayed open, the steam was followed by water and forced out the rupture disks (that's what they are for: As with freeze plugs in an automobile engine, it is better to lose the plugs than the machine). A path was now provided for the water to leak out from the pressure vessel through the pressurizer and the still open relief valve to the floor of the containment building, and the water began flowing out. As soon as the pressure and the water level dropped, the big moment in 22 years of nuclear power history had come: The first occasion for the Emergency Core Cooling System to be activated in a real emergency.

It would never work, the Kendalls and Naders had been yelling; the steam wouldn't let the water in, the tests were on too small a scale, they were nothing but staged theatrics and computerized eyewash.

Now the big moment had come. Within seconds, years of anti-nuclear propaganda were shattered as the ECCS came in automatically, instantly, reliably, unobstructed by Kendall's kinky concoctions. It can take bigger holes than an open relief valve, injecting water much faster than it leaked out through the stuck valve in the pressurizer, so that water and pressure were restored almost immediately and everything would have been OK — if the operator had realized that the water was leaking out through the relief valve (which could have been closed, or failing that, there are provisions for putting the ECCS into a closed circuit pumping the water through the sump back into the reactor).

Instead, he did what amounted to lighting a third match in a gasoline refinery: He switched off the ECCS. (Don't blame him with hindsight — yet. He may have been fooled by correct, but misleading pressurizer readings.) The water again leaked out through the open valve, but this time the ECCS had been disabled, part of the core was exposed, hydrogen was produced in a reaction between the zirconium cladding and water at high temperatures, and by the time the open relief valve was detected and closed, and water restored to the vessel, the now famous hydrogen bubble had coagulated. It allowed only slow circulation of the cooling water and slow reduction of its temperature (turning the pumps on at full power would have risked damaging them severely, and there were many safer options open).

In the meantime, a fourth match in our analogous gasoline refinery had been lighted: The radioactive water on the containment floor was pumped automatically into the take-up tanks in the auxiliary building and — fifth match! — overflowed them. Whether this pump came on by a fishy coincidence (5.5 min after the ECCS had been activated), or by a design error that fails to test the water for radioactivity (for example) is not known to this writer. But once again, there is defense in depth even here: The filters in the drains let out virtually no radioactive material other than Xenon, an inert gas that reacts neither with the filters nor with the human body and does not give it an internal dose (see below).

The final mishap occurred on Friday, 3/30, when the water was pumped back into the containment building (where it should have stayed harmlessly all the time); some water was spilled, giving rise to a puff of radioactivity. It resulted in a minuscule dose in Pennsylvania, but gigantic headlines in New York (both are discussed below).

SAFETY PRINCIPLE VINDICATED

There are no second and third chances in any other large-scale energy facility; but on 3MI, after a chain of five independent, hair-raising failures, there were plenty of backups before a meltdown was even close. But what if everything else had failed and a meltdown had actually taken place?

It would have taken hours for the pressure vessel alone to melt, during which time the neighboring population could have been evacuated, just in case the containment building would have cracked and let out radioactive gases.

But in all probability it wouldn't have. What makes us so confident?

An item that the Pulitzer-prize hunting scaremongers had missed. At 2 p.m. on 3/28 the instruments in the containment building recorded a pressure spike, which was almost certainly a hydrogen explosion. While the would-be reporters were speculating about an explosion of the hydrogen bubble inside the reactor vessel (where there was little or no free oxygen, and no possibility of a spark to set it off), an explosion had already taken place in the containment. Why would the building that withstood the explosion (it must also withstand a 300 mph hurricane and the impact of a jetliner at landing speed) fail to contain gases at much lower pressures?

But the defense in depth, which kept a meltdown remote at all times, is only half of the principle of nuclear safety. The other half is the slowness with which the danger approaches, giving the defenders ample time for countermeasures. Within hours, the industry had flown in teams of experts; one such team engaged in almost Naderite "what-if" fantasies. What if the pump fails? We use the other primary loop (our figure shows only one of two). What if that fails, too? We have the ECCS. What if both loops fail because the power fails? We have a diesel stand-by generator. What if that fails, too? Let's fly in another. And they did.

There is not just the defense in depth; there is also the time to bolster it in the places where it might grow weak. On both counts, nuclear safety has withstood a test in the field, under the most aggravating conditions, with plenty of resilience to spare.

Yes, there will be a lot of recriminations and rethinking in the industry. We will wait for the full explanation before jumping to conclusions about human failures, design errors or even darker possibilities. On the other hand, the incident revealed at least three highly reassuring items:

- The ECCS has now been tested under "battle conditions" and came through with flying colors.
- The containment building, which is meant to contain radioactive gases *after* a meltdown, withstood a hydrogen explosion.

• Perhaps most [illegible] assumed to melt after exposing [illegible] exposed (partially, top only) for [illegible] hours, ½ hour, and 6 (six!) hours, respectively. No doubt the exposed parts of the fuel rods will be found badly damaged, bent and burst; but they did not melt (almost no uranium was found in the water coming out of the core). The Rasmussen Report was wrong here, after all, at least for this type of zirconium core: It was far too pessimistic.

RADIOACTIVITY

The sum total of radioactivity released in the Harrisburg Grand Disaster was 80 millirems (official testimony by HEW Secretary). That is as much *additional* radiation as a certain kind of person would receive by moving from Pennsylvania into the editorial offices of this newsletter (elevation 7,200 ft in the ore-rich Rockies) for less than a year. What kind of person? The kind that stood naked near the plant 24 hours a day for the entire episode.

But that is not all, for rems alone do not tell the whole story. Practically all of this was due to Xenon, which is inhaled and breathed out again without reacting with the body. How about iodine, which gets into the food chain and lodges in the thyroid gland, possibly causing thyroid cancer? The level of iodine activity was 1/20 (one twentieth!) the level resulting in Pennsylvania from the fallout from the Chinese bomb tests in 1976 (when all those protest demonstrations were held against Red China by the Fondas, Naders and Ellsbergs, remember?).

This time the iodine level in milk was only 22 picocuries/litre (pC/l); the EPA and NRC start kicking when it reaches 1200 pC/l. Patients given radioiodine in diagnostic tests leave the hospital with up to 30 millicuries (30 billion pC) in their bodies and radiate a lot more than the milk "affected" by the Pennsylvania non-disaster. Not long ago, a lady who was given such a test went on vacation with her husband immediately afterwards. He was given a dosimeter by researchers of the U. of Mich. to see how much radiation he would absorb from his wife (most of it in the first two days). After they returned, his dosimeter was read: 2.5 rems! That is 12 times more from his wife than the "victims" in Pennsylvania received from the reactor in all of the "nuclear nightmare."

And we are still talking about iodine given to *healthy* patients. Patients with cancer of the thyroid are given up to .2 curies, or 50 billion times more than is found in a quart of "contaminated" milk.

But the most important comparison is the milk before and after the Grand Disaster. There was no significant change.

In fact, the milk imbibed by William Penn was only slightly less radioactive than it is now.

THE PRESS

The electronic media monopoly, the wire services, the daily press, and the boys from Slime and Newspeak had a field day. Typically, *Time* not only gave a false story of what had happened, but its reporters do not even understand the principles of a healthy reactor. "The reactor and primary loop," they scribbled, "are shielded by a thick containment dome, which should prevent the venting of any radioactivity into the atmosphere — as long as a meltdown does not occur." And the purpose of a parachute, they might have added with their logic, is to prevent injuries to the pilot — as long as he remains inside the plane.

But the boys from Slime and Newspeak are not merely technologically incompetent, they flunk even as journalists. Like "investigative" reporters Bernstein and Woodward, they know only what is handed to them by Deep Throats on a silver platter. What they missed was no less than a hydrogen explosion (see above): finding out would have taken all the brilliant investigative wits of reading the NRC Bulletins.


NEW YORK POST FINAL

NUKE LEAK GOES OUT OF CONTROL

Evacuation would hit one million

Feds to probe nuke leak at Indian Point

Fallout vigil begins here

Radiation riddle of Louise's goats

30 March: The "leak" at Indian Point was 10 gallons of water, which had 15 pC/l; whiskey has 1200, and salad oil 4900.

Was there nobody to save the good name of the US press?

Oh yes, there was: The one remaining standard bearer of American journalism, the *National Enquirer*. As we go to press, we understand that its 4/24 issue will point out to its 20,000,000 readers how the American people were hoaxed by a vicious and ignorant press.

The *National Enquirer*!

Some day Tom Wicker and Jack Anderson will measure up to it.

THE POLITICOS

If there was anything more despicable than the press, it was the politicians catering to it. Yes, there were exceptions: Rep. Ron Paul of Texas' 22nd district, for example, went on record immediately in defense of nuclear power ("As a physician strongly concerned with health and safety, I prescribe more nuclear energy, not less for the people of our country . . ." See *Congressional Record* 3/29/79, p.E1415).

In contrast, most other politicians were quick to sense that votes were to be had for as cheap a price as human lives, to be endangered by far less safe power sources. Leading the pack, predictably enough, was Governor Jerry Brown-out, who reached a new low in political cynicism: He publicly demanded the shut-down of Rancho Seco nuclear plant, privately knowing only too well that his state cannot do without the power from a hydroelectric dam that could kill more than 100,000 people if it fails — but of course it will *not* fail, not until the next earthquake. Jerry Brown for President!

What with the new ethics, politicians can no longer be bought for money. Ah, but what about a modest sum of dead, crippled and diseased? There is an off-chance that some pols are too dull-witted to realize that nuclear power replaces more dangerous power sources, but at least two politicos, Rep. Udall of Arizona and Sen. Hart of Colorado, are in a different class. Far be it from us to bat for the intellectual brilliance of these two honorable members of the body politic (Hart, as McGovern's campaign manager in 1976, managed the biggest disaster in the history of US presidential elections), but as chairmen of congressional committees involved in nuclear safety they might have done a little homework.

Anyone even slightly familiar with the risks of nuclear power and those of evacuation (heart attacks of the elderly, traffic accidents, etc.) knew on Sunday, 4/1, what the odds for either were, and if Hart did not know, he could have found out from

the interagency team of specialists of HEW, EPA and NRC far more easily than we did. Their figures were these: Expected cancer deaths among the population in a 50-mile radius *over the entire lifetime of that population* (now dying of cancer at the rate of 3,692/year): 0.36, or to the nearest integer, zero. Expected deaths in the evacuation of the population in a 20-mile (not 50-mile!) radius: 5.4, or to the nearest integer, five.

Sen. Hart had no authority to call for an evacuation; but he did the next best thing: On TV, identified as chairman of the subcommittee for nuclear regulation, he pompously announced that he would immediately evacuate *his* family if it lived in the area.

After all, it was ony 5 human lives. Why should they not perish for the greater glory of Sen. Hart's political ambitions?

(Incidentally, if Hart wanted to reduce the dangers of low-level radiation for his family, he could do so: He could evacuate them from mile-high Denver to Harrisburg.)

Sen. Edward Kennedy, who knows that politics come before health, rushed into hearings of his Subcommittee on Health with indecent speed to make political hay before anybody else. As the incomparable Victor Lasky said in a sample of his repartee to a scaremonger phoning his radio show: "More people died at Chappaquiddick than at Harrisburg . . ."

THE PSEUDO-SCIENTISTS

But there are even lower depths below the sewer of journalists and politicians who put ideology above human lives. There is a handful of ex-scientists who do the same thing, but without the defense of ignorance.

Following the Harrisburg incident, Prof. G. Wald penned his most vicious article yet. Charging deliberate deception by the nuclear industries, he makes statements such as these: "[Plutonium] is perhaps the most toxic substance known. . . If you were to inhale a milligram, you would be dead of massive fibrosis of the lungs within hours."

Coming from most other people, such statements would probably be regarded as hilarious blunders. Coming from a Nobel Prize winner in physiology and medicine, we fail to see how they can be interpreted as anything but a deliberate lie. (We have commented on the toxicity of plutonium before; as for fibrosis, we checked with a health physicist who studies the biological effects of plutonium: When 1.6 mg of it is inhaled by dogs, the first signs of fibrosis appear after 300 to 400 days.)

Another ex-scientist who kept shouting "I told you so!" just as soon as every prediction he had made was shattered, was our old acquaintance Prof. Henry Kendall. He had built a lucrative career on the alleged malfunction of the ECCS; within hours of the news that it had functioned perfectly and at a time when he knew (or certainly could have found out) that there was no immediate danger of a massive release of radioactivity, he called for evacuation of the population, with its inevitable fatalities. In an interview given to the *National Enquirer*, he not only painted a meltdown with horror stories of 100,000 deaths, the slaughter of the children under 12, the massively polluted rivers, and general apocalypse that would scare the pants off Count Dracula, but he out-Nadered Nader in forgetting to use the weasel words "could" and "might;" it was always what *will* happen in a meltdown.

There are two interesting aspects to this. One is that while Prof. Kendall is apparently persuaded of these super-horrors that have not yet occurred even to Hollywood's bloodiest disaster film writers, he keeps assuring us in the propaganda pieces of the Union of Concerned Scientists that he does not want to halt nuclear power, he merely wants a temporary moratorium. He has apparently not [illegible] himself with visions of polluted landscapes littered with corpses, and one wonders what kind of technology *would* turn the good professor off. Artificial earthquakes with rockets releasing the bubonic plague?

The other interesting aspect is this: Kendall's description of what *will* happen in a meltdown was given at a time when the core was still hot and the bubble quite large. In a meltdown, he asserted confidently, the radioactive gases *will* escape through the cracks in the containment building. In reality, as he could easily have found out, the containment building had withstood a hydrogen explosion without any structural damage several days before Kendall gave his interview.

So much for the concoctions of Kendall, the crafty crack creator.

WHY WAS THE HYDROGEN BUBBLE NOT FORESEEN?

It was. Engineers knew about the reaction that produces hydrogen and immediately diagnosed the trouble. (Remember that they had no direct access to the core, and had to make inferences from instrument readings and computer simulations.) What they had not foreseen was a sequence of events (including the ECCS being switched off manually) in which the core would remain exposed for more than a few seconds or minutes.

In a way, the incident is similar to the Browns Ferry: Everybody knew that the insulation could catch fire, but nobody foresaw a wise-guy who would use the open flame of a candle on it. After the Browns Ferry fire, hundreds of miles of cable were pulled out in plants under construction and replaced by cables with fire-resistant insulation. When the dust settles from the 3MI incident, there will be many changes, and one of them will doubtlessly be a provision to bleed off any gases that might lodge in the cooling loop.

But the next incident, and by the iron laws of probability there will eventually be one, will be of yet another kind, except that it will again be unforeseen. Nobody, least of all a federal bureaucracy (which is now being clamored for) can foresee everything. But the trick of nuclear safety is not to foresee *everything*, it is to contain *anything*.

The principle of guarding against the unforeseen, whatever it may be, by a multilayered defense, and by providing the time to bolster that defense where necessary, paid off at Browns Ferry, paid off at Harrisburg, and will pay off again in the future.

The impossibility of applying this principle to other power sources, with their diluted dangers, is what will continue to make them less safe.

THE RADIATION CONTROVERSY

is the title of Dr Ralph Lapp's long awaited book, and it is a treasure. Here are the facts and statistics: low-level radiation, cancer incidence by geography and occupation, Mancuso, Sternglass — the works. A must for every active superstition buster; and for everybody else as well. $2.75 from Reddy Communications, 537 Steamboat Rd., Greenwich, CT 06830.

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