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REPORT BY THE  
**Comptroller General**

OF THE UNITED STATES

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RELEASED

**GAO's Analysis Of Alleged Health And Safety Violations At The Navy's Nuclear Power Training Unit At Windsor, Connecticut**

At the request of the Chairmen, Subcommittees on Environment, Energy and Natural Resources, and Legislation and National Security, House Committee on Government Operations, GAO investigated 17 allegations of radiation and industrial health and safety violations at the Windsor facility. The allegations referred to specific events considered symptomatic of potentially dangerous conditions.



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In 5 of the 17 allegations, procedures or safety standards were violated, including one case with the potential for a serious personnel injury. None of the five violations involved radiation exposure to personnel, and all were investigated by Windsor facility officials at the time they occurred. In GAO's opinion, none of the events forming the bases for the 17 allegations, including the 5 cases in which violations occurred, were indicative of basic health and safety-related weaknesses in the facility's operations.



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COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON D.C. 20548

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✓ The Honorable Jack Brooks, Chairman  
Subcommittee on Legislation and  
National Security  
Committee on Government Operations  
House of Representatives

*ASE 01506*

<sup>A.</sup>  
The Honorable Toby Moffett, Chairman  
Subcommittee on Environment, Energy  
and Natural Resources  
Committee on Government Operations  
House of Representatives

*ASE 01508*

*DLG 05525*

In a joint letter dated April 11, 1980, you requested that we investigate allegedly dangerous conditions at the Navy's Nuclear Power Training Unit at Windsor, Connecticut. The Windsor facility is one of eight naval prototype nuclear propulsion facilities throughout the country. Each facility has a nuclear reactor and replicates the reactor compartment and engineering space aboard a nuclear-powered Navy ship. These facilities serve two purposes: (1) research and development of new reactor designs and (2) the training of sailors for sea duty as naval nuclear propulsion plant operators. Currently, the Windsor facility is used exclusively for training purposes. All eight facilities are under the administrative control of the Department of Energy's Deputy Assistant Secretary for Naval Reactors.

In a December 3, 1979, letter to Congressman Toby Moffett, two former naval instructors assigned to the Windsor facility from July 1978 through August 1979 made 17 specific allegations of radiation and industrial safety and health violations at the facility. On August 27, 1979, the instructors were transferred from the facility because they refused to accept the findings of their commanding officer's investigation into their concerns about a major test procedure conducted on August 16 and 17, 1979. These concerns were restated as 1 of the 17 specific allegations detailed to Congressman Moffett. The allegations dealt with matters such as (1) valves which leaked radioactive water and steam, (2) personnel exposure to asbestos dust, (3) frequent malfunctions that caused unplanned facility shutdowns, and (4) improper disposal of contaminated materials.

Our evaluation of the 17 alleged violations did not reveal any evidence of basic health- and safety-related weaknesses in the Windsor facility's operations. Five of the 17 allegations, however, did involve violations of established procedures. None of the violations involved radiation exposure to personnel. Of the five violations, only one instance was potentially dangerous. In that case, a serious personnel injury could have occurred. In all five cases, corrective actions were taken to prevent reoccurrence of the violations.

We conducted our evaluation about 1 year after the events forming the bases for the 17 allegations occurred. These events were not of a continuing nature, but were confined to specific time periods ranging from a few minutes to a few days. Consequently, we had to rely primarily on Windsor facility records surrounding these events, and secondarily on interviewing personnel assigned to the facility. In this sense, the results of our evaluation should be qualified in that we relied on these records and interviews as representing a fair and accurate account of the facts, circumstances, and events surrounding each allegation. The appendix to this letter discusses each allegation in detail to the extent we could in an unclassified report.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time, we will send copies to the Department of Energy and other interested parties, and will make copies available to others upon request.

On August 25, 1980, we briefed your respective offices on the results of our evaluation. In asking for this report to document our findings, they directed that we not obtain Department of Energy or Department of the Navy comments. We did, however, discuss our work results with the Deputy Assistant Secretary for Naval Reactors, Department of Energy.

  
Comptroller General  
of the United States

ALLEGATIONS OF HEALTH AND SAFETY VIOLATIONSAT THE NAVY'S NUCLEAR POWER TRAINING UNITAT WINDSOR, CONNECTICUTBACKGROUND

The Windsor, Connecticut, Nuclear Power Training Unit is one of eight land-based naval prototype nuclear propulsion facilities throughout the country. Over a 5-year period, starting in fiscal year 1981, the Department of Energy (DOE) plans to spend \$103 million, primarily at the Windsor facility and at two other older prototype facilities, to replace equipment and modify engineering safety features. DOE's purpose is to (1) upgrade each facility's capabilities to the level of the newest prototypes and (2) enhance continued safe operations. The changes will upgrade the emergency fluid and electrical supply systems. The new features will be designed for redundancy, providing for additional systems such as back-up power supplies, and state-of-the-art electrical control and instrumentation systems. New support buildings will house auxiliary control rooms designed to provide back-up remote control of engineered safety systems. All the changes will be based on the latest Federal safety regulations.

Although various facilities will undergo certain safety-related modifications, officials in DOE's Naval Reactors program state that the Navy's standards, procedures, and controls are in most cases considerably more stringent than those imposed by the Nuclear Regulatory Commission for radiation safety standards, and by other organizations responsible for setting industrial health and safety standards. They pointed out that as a result of these strict standards, no one in the naval nuclear propulsion program has exceeded the federally established radiation limits for quarterly or annual occupational exposures since 1967, and no one has ever received more than one-tenth of the Federal internal radiation exposure limit.

In a December 3, 1979, report to Congressman Toby Hoffett, two Navy personnel who were trained at Windsor and served as instructors there from July 1978 through August 1979 made 17 specific allegations of dangerous conditions at the facility. Earlier, on August 16, 1979, the two individuals complained of potential violations of established health and safety procedures related to a major

test being conducted at the Windsor facility. On August 27, 1979, they were transferred from the facility for refusing to accept the findings of an investigation into their complaints.

#### SCOPE AND METHODOLOGY

We evaluated each of the 17 allegations to determine their accuracy and, if accurate, whether actual or potentially dangerous conditions existed at the Windsor facility. In investigating the specific allegations, we met with officials of DOE's Deputy Assistant Secretary for Naval Reactors, management of the Windsor facility, 1/ and the Commander of naval personnel at the facility. We also talked with one of the individuals making the allegations. The other individual was at sea and could not be reached.

When we began our evaluation, officials of DOE's Deputy Assistant Secretary for Naval Reactors were not aware of all of the 17 allegations. Therefore, we provided them with the specific allegations, and afforded them the opportunity to conduct their own internal investigations and report the results to us. We then verified the results of their investigations by reviewing official records maintained by the operating contractor at the Windsor facility. This approach permitted DOE to acknowledge at the outset of our evaluation which of the allegations were accurate and which, in the Department's opinion, were not. It also helped us to avoid delays inherent in reviewing classified reports and records of day-to-day operations. Finally, during our visit to the Windsor facility, we observed the specific equipment and plant areas mentioned in the allegations and confirmed that procedural controls were in place and working. Following is an unclassified discussion of each of the 17 allegations.

#### ALLEGATION 1

"The leaking of a primary system valve containing radioactive water into an occupied, uncontrolled, easily accessible area. For a period of at least six months and possibly to this very date a valve frequently leaked while the valve was being operated. This valve is operated on

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1/The Windsor facility is operated for the Department of Energy by the General Electric Corporation and the Knolls Atomic Power Laboratory.

nearly a daily basis. The valve was never replaced as of August 27, 1979, although it was known to be leaking by senior supervisory personnel."

GAO comment

This allegation relates to the leaking of radioactive water from a valve used to drain primary coolant from the reactor coolant system to a radioactive liquid waste tank.

According to Windsor facility records, the valve in question operated properly and within technical specifications, but leakage from around the valve packing was detected in June 1979. DOE officials told us that periodic valve packing leakage is normal, provided it remains within established design limits. Such leakage is corrected by adjusting or tightening the packing. Standard packing tightness is acceptable when no drops large enough to fall or flow away from the packing appear in a 5-minute period. According to Windsor officials, a June 1979 evaluation of the packing leakage showed that when the valve in question was not in use, the leakage could be contained by the valve cap, and that when the valve was in use, it could be contained by normal radiological control procedures.

According to DOE officials, the packing leakage described in this allegation is not unusual. Windsor facility records show that the valve packing was adjusted at the next scheduled reactor maintenance shutdown in August 1979. Since the valve was capped when not in use and the leakage was contained and controlled with normal radiological control practices, we do not believe that it imposed a radiological hazard.

ALLEGATION 2

"The leaking of a good number of secondary system steam valves into engineering spaces. On a frequent basis, there were always many steam leaks into the engine room, creating a potentially hazardous situation."

GAO comment

The secondary system mentioned in this allegation does not contain radioactive materials. Release of radioactive material or exposure of Windsor personnel to radiation was not a part of this allegation. The potential danger is that steam leaks could result in personnel receiving burns.

During our visit to Windsor, we observed operations in the engine room and adjacent engineering space. We also reviewed Windsor dispensary records covering the past 5 years and found no record of personnel receiving treatment for injuries resulting from steam leaks. We also reviewed the 1978 and 1979 nuclear safety audit reports prepared by an audit team from the headquarters office of Knolls Atomic Power Laboratory. According to the reports, none of the steam leaks mentioned were significant enough to cause a personnel safety hazard. Officials at Windsor said the quantity and magnitude of leaks at the facility are not unusual for a Navy steam power plant.

Navy officials said steam leaks such as those mentioned in the allegation are inherent to the operation of steam power plants. While secondary system leaks have occurred and are likely to occur periodically, these officials contend that the frequency and significance of the leaks at Windsor do not represent an unusual or unexpected hazardous situation. We agree.

### ALLEGATION 3

"During a maintenance shutdown during the first part of 1979, MM2 Murphy was instructed to enter the reactor compartment and remove a drain plug in a potentially contaminated bilge area following a pressure test of the system. When told by General Electric Representatives that the system was completely depressurized, he removed the drain plug. Upon removal, the plug flew off and potentially radioactive water sprayed on MM2 Murphy and a large area of the reactor compartment. Fortunately, there was no spread of contamination."

### GAO comment

In this case, it is alleged that a system was not fully depressurized as operating procedures require. As a result, when a technician removed a drain plug in a potentially contaminated area, the plug unexpectedly flew off and water sprayed over the technician. An investigation conducted by Windsor officials, however, found no record of the incident. In examining the engineering and maintenance logs for this period, we found no mention of a system pressurization problem, or of events related to this allegation. We were unable to determine whether or not this accident actually occurred. Because the incident was not reported, no corrective action could be taken.

Concerning the potential radioactivity of the water which would have been in the system when the incident occurred, Windsor officials explained that the level of radioactivity in the water normally pumped through the piping is about the same concentration as the maximum level permitted by Federal regulations for drinking water. <sup>1/</sup> If the incident had occurred, they said, it would have had to have taken place after a system pressure test which was conducted during a maintenance shutdown period. They said this test is conducted with pure water.

#### ALLEGATION 4

"There constantly existed a severe problem with the leaking of Freon 12 into the engine room. This problem may still exist. Freon 12 in sufficient concentrations can be a very harmful atmospheric contaminate."

#### GAO comment

Our review of Windsor records disclosed that while Freon leaks occurred, they did not result in atmospheric concentrations greater than those permissible under existing Navy standards.

The Navy's Submarine Atmospheric Control Manual establishes the limits for atmospheric concentrations of Freon. The manual allows concentrations of 200 parts per million for a continuous 90-day exposure period and 1,000 parts per million for a continuous 24-hour exposure period.

According to Windsor officials, Freon leakage was not a problem during the period covered in the allegations. However, from December 1979 to February 1980, they considered the rate of Freon usage and leakage in the engineering areas to be excessive. Because the facility is continuously ventilated with fresh air, however, they were not concerned with the atmospheric concentrations as much as they were with the consumption of Freon and the necessity of recharging the air conditioning equipment every other day. Windsor facility records for this period show that freon atmospheric concentrations in the area adjacent to the air conditioning equipment ranged from 40 to 60 parts per million. Samples taken in the bilge area, which is unoccupied space, were about 100 parts per million.

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<sup>1/</sup>Normally, radioactivity levels in drinking water are far less than the level Federal regulations permit.

The air conditioning equipment was repaired in February 1980. According to Windsor officials, subsequent weekly checks during normal operations indicated negligible leakage.

#### ALLEGATION 5

"During the month of June 1979, an unplanned shutdown occurred that resulted in the Main Coolant Pumps being turned off and the subsequent initiation of Emergency Cooling. Some insulation was required to be removed from the emergency cooling system in the reactor compartment. MM2 Murphy was told by the Maintenance Training Group Officer to remove the insulation. Murphy asked Ltjg Mueller (Maintenance Training Group Officer) whether the insulation was fiberglass or asbestos. Murphy was told by Mr. Mueller that the insulation was definitely fiberglass. Subsequently, no controls were taken for asbestos ripout. Murphy inhaled the thick dust, and half way through the work, he was informed by a co-worker qualified in asbestos ripout, that the insulation was asbestos. When confronted with this, Mr. Mueller appeared to know the insulation was asbestos, but that the job had to be done expeditiously (no time for proper controls). To this date, no asbestos physical has been performed on Murphy."

#### GAO comment

The essence of this allegation is that the technician was assisting in removing a 4-inch strip of insulation around a 3-inch diameter pipe and that because proper procedures were not followed, he inhaled asbestos dust.

An investigation conducted by Windsor facility management in December 1979 concluded that the personnel involved in removing the insulation did not follow all of the established procedures for removing asbestos insulation. They wore full coveralls and half-faced respirators, as required, but they did not wet the insulating material nor use a vacuum cleaner to minimize the dust generated when the material was removed.

When the Windsor facility was built, the original construction used asbestos material to insulate high-temperature components. In January 1976, Windsor personnel began substituting fiberglass insulation whenever old insulation was replaced. As a result, some of the plant's components are still insulated with asbestos and others with fiberglass. Not all of the insulation, however, is clearly marked, nor is it possible to visually distinguish between the two types of insulation materials. Therefore, site operating procedures

require that personnel handling unidentifiable insulating material proceed on the assumption that asbestos is present. In this case, the personnel failed to follow some of the required asbestos handling procedures. Following completion of their investigation of this incident, Windsor officials provided refresher training to facility personnel in proper asbestos handling procedures.

#### ALLEGATION 6

"During the month of May 1979, Murphy was directed to shut a primary system valve. This was during a maintenance shutdown. Upon operating this valve, a large plume of potentially radioactive steam blew in his face. Contamination swipes taken on the valve indicated several thousand microcuries of activity. MM2 Murphy asked his leading officer, Lt. Bandhauer, to have his lungs monitored for radioactivity. Lt. Bandhauer discounted the fact that he needed his lungs monitored due to the fact that airbourne activity samples taken in the vicinity of the valve, after the incident occurred, indicated less than the airborne limit for radioactivity. The potential for inhalation of radioactive contamination still existed, and should not have been ignored."

#### GAO comment

In May 1979, a burst of potentially radioactive steam blew into the face of a technician operating a primary system valve. The technician requested that his lungs be monitored for radioactivity, and alleges that the request was discounted by his superior.

Windsor facility officials investigated this incident in December 1979, after MM2 Murphy brought it to their attention in a telephone conversation. According to their report, radiation surveys showed no measurable airborne radioactivity. Radioactive contamination was found only on the valve packing gland. Based on these surveys, even if the technician had inhaled all of the radioactivity which leaked out, he would have received a radiation exposure of less than one one-hundredth of the Federal limit for members of the general population. According to Windsor officials, this amount was too small to detect in an individual's lungs. When the technician left the reactor compartment, no radioactivity was detected on him during routine monitoring for external radioactive contamination. According to these officials, if radioactivity had been internally deposited in the technician's lungs at levels

which would cause him to exceed Federal exposure limits, it would have been detected by such monitoring.

About 2 months after this incident occurred, the technician making the allegation was transferred from the Windsor facility to sea duty. At that time, the technician's lungs were monitored as a normal part of a transfer from the Windsor facility. No internal radioactivity was detected. Windsor officials stated that if the individual had inhaled a significant amount of radioactivity as a result of the May 1979 incident, a portion of it would still be present in his lungs. We agree.

#### ALLEGATION 7

"In the month of June 1979, there were nearly 20 days of unplanned shutdown time due to malfunctions in [various reactor control equipment and coolant chemistry conditions being out of specifications.] <sup>1/</sup> Just the sheer number of malfunctions indicates a need for more scrupulous upkeep and maintenance for a safe nuclear powerplant. The Windsor prototype is over 20 years old, and is located only 8 miles outside the city of Hartford, CT."

#### GAO comment

According to Windsor officials, total unplanned shutdown time for all of 1979 was 27 days, and the total June 1979 unplanned shutdown time was slightly more than 5 days. Our review of the Windsor facility's daily activity reports for June 1979 showed six unplanned shutdowns totaling 124 hours. Of the six shutdowns, five were caused by equipment failure or malfunctions, and one was caused by operator error. Of the shutdowns resulting from equipment failure or malfunction, four were due to problems with electrical circuits or instrumentation and the other to a control panel switch failure.

None of these equipment malfunctions or failures, nor the operator error, appeared to be indicative of generally poor maintenance or facility operations. We could not reconcile the difference between the alleged amount of unplanned shutdown time and the amount shown in Windsor facility records.

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<sup>1/</sup>The original text of this allegation contained information classified by DOE. The language within the brackets was substituted.

ALLEGATION 8

"In the month of June 1979, [coolant chemistry conditions out of specification] 1/ existed in the primary system due to procedures that were inadequately written. The Main Coolant Pumps were directed to be turned off by one supervisor. Then another supervisor directed the pumps to be turned back on. Total confusion resulted."

GAO comment

This incident was investigated by Windsor officials immediately after it occurred. Their report concludes that the cause of the incident was improper interpretation of procedures by operating personnel.

Under certain coolant chemistry conditions, Windsor facility operating procedures require that the main coolant pumps be turned off immediately and not restarted until authorized by DOE Naval Reactors headquarters officials. Windsor facility records show that the plant engineering officer, acting on indications of potential coolant chemistry problems, properly shut down the main coolant pumps. After analyzing the primary system coolant and confirming the abnormality, Windsor supervisory officials mistakenly concluded that the pumps could still be operated. One pump was then operated for about 8 minutes. Meanwhile, Windsor facility management reviewed the procedures and determined that DOE headquarters authorization was required before any of the pumps could be restarted. The pump was then shut down until such authorization had been obtained.

Windsor facility investigation records showed the improper interpretation of operating procedures as the cause of the problem. As part of the corrective actions taken in response to the investigation report, these procedures were changed.

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1/The original text of this allegation contained information classified by DOE. The language within the brackets was substituted.

ALLEGATION 9

"In the month of July 1979 an engine room bilge was found to be contaminated with radioactivity. The contamination was from a spill of radioactive liquid from an improperly engineered radioactive drain assembly. Murphy and Doody made it known to the leading officers and General Electric representatives that the area that was contaminated should have a permanent boundary cover to ensure there would be no further spread of contamination. This was a requirement of the manual for radiological controls that is used by the NAVY. Instead of constructing a permanent boundary, supervisory personnel decided to label the area as 'fixed contamination' instead of 'loose contamination,' thereby not requiring a permanent boundary. Loose contamination still existed in the area and the spread of contamination was conceivably possible. Later that month, students who were cleaning near the area were found to have been working with contaminated rags. These rags ended up in an uncontrolled dumpster and were headed for the local dump. Fortunately the rags were found. We question the possibility of how much contaminated waste escaped detection in the dumpster prior to the site having such a sensitive instrument to detect radioactivity in the dumpster. (Note that the site has been in operation for the past 20 years using a less sensitive instrument to detect radioactivity in this dumpster). There has been at least 4 occasions in 1979 when contaminated waste was found in this dumpster. The bilge remained contaminated for at least a six month period."

GAO comment

The essence of this allegation is that the classification, control, and disposal of radioactive contamination was improper and may have posed a radiological hazard to Windsor facility personnel and the public. In this instance, the source of the radioactive contamination was about the same concentration of radioactivity permissible by Federal regulations in drinking water.

The contaminated bilge area was originally designed to remain permanently contaminated. According to Windsor officials, a modification to the bilge piping system and subsequent clean-up of loose surface contamination in the area was undertaken in 1979 as part of the Navy's program to improve radiological controls. These actions resulted in the removal of the area's "permanently contaminated" designation. Afterward, weekly surveys showed no loose surface contamination. What was not known at the time, however, was that the paint in the bilge area had absorbed some radioactivity.

The paint's radioactivity was discovered after the bilge area was cleaned, and part of the paint was removed and disposed of with cleaning rags. Initially, contamination of the rags was not detected, and the rags were improperly disposed of in the site dumpster as normal trash. Failure to detect the contamination on the rags as they were removed from the facility was a violation of operating procedures. The contaminated rags were discovered subsequently during a routine check of the dumpster with a radiation detector. As an additional radiation safety precaution to prevent inadvertent off-site disposal of trash contaminated with radioactivity, Windsor facility procedures require such checks before the dumpster can leave the site. It was at this point on July 5, 1979, that Windsor facility officials first learned that the paint was radioactively contaminated.

The bilge area was then posted as having controlled surface contamination with fixed contamination in the paint. The officials said a physical barrier is not required when action is in process to decontaminate an area. According to Windsor facility records, the radioactive paint was removed from the bilge on October 10, 1979.

Windsor facility officials told us the requirement for dumpster radiation checks has been in place for over 10 years. Our review of site radiation survey records revealed that on four occasions during 1979 and one in January 1980, low-level radioactivity was detected in the dumpster. The highest radiation level detected, according to these officials, was about equal to the radiation given off by some radium dial watches.

The Windsor requirement to make radiation checks before a dumpster can leave the site appears to be an adequate safeguard against the accidental off-site disposal of low-level radioactive waste as normal trash.

#### ALLEGATION 10

"In the month of May 1979, the CO2 concentration inside the hull containment building at the site was found to be 19,000 ppm. This was detected approximately 24 hours after ventilation was thought to be restored to the building. There is a 'spike' limit on CO2 of 15,000 ppm as indicated in Enclosure 15 of Enclosure 1 to this letter. The federally established limits may have been exceeded. Problems began to occur with the plant at around midnight, directly related to the CO2 concentrations. The 19,000 ppm sample was taken at approximately 11:00 a.m. So far at least 11 hours, CO2"

"levels were excessively high. The CO2 was not detected sooner due to a lack of training and awareness in regards to industrial hygiene. Personnel on watch experienced severe headaches, and although all the students were ordered to leave the building, no staff watchstanders were relieved. These were the people who were controlling the reactor plant."

GAO comment

The essence of this allegation is that a lack of training and awareness of industrial hygiene resulted in the undetected build-up of excessive atmospheric levels of carbon dioxide (CO2) inside the plant's reactor compartment. The high CO2 concentrations caused plant personnel to experience severe headaches.

Windsor officials investigated this incident immediately after it occurred. The cause of the excessive atmospheric CO2 concentrations was a closed hull ventilation exhaust valve which should have been opened during preparations for plant start-up. The failure to open the exhaust valve was not recognized immediately, but was discovered 21 hours later while plant operators were investigating an apparent problem with secondary system chemistry.

About 9 hours after plant personnel began routine preparations for plant start-up, they detected an apparent problem with the plant's secondary system water chemistry. After 12 more hours of investigation, plant personnel concluded that excessive atmospheric CO2 concentrations were contaminating their chemistry samples. An atmospheric sample was then taken which was found to be 19,000 parts per million CO2. The applicable standard for an 8-hour day is 5,000 parts per million. An immediate check of the hull ventilation alignment was performed, and the ventilation exhaust valve was discovered to be shut instead of open. The report on this incident concluded that the technician who operated the valve during start-up preparations did not check the air duct for proper air flow as required. The individual who made this mistake is one of the sailors who made this allegation.

Although the threshold limit for CO2 is 5,000 parts per million for an 8-hour day, an American Conference of Governmental Industrial Hygienists' discussion of CO2 effects on submarine personnel exposed continuously to 30,000 parts per million reports that with near-normal oxygen levels, their health has been only slightly affected.

Test area oxygen levels were not measured. It appears, however, that oxygen levels were high enough to offset potential health affects of the high CO2 concentrations. Windsor facility engineering logs and other records contain no indications of personnel reporting headaches or other health problems during the period when the incident occurred. Windsor investigating officials told us that when they subsequently interviewed Navy and contractor personnel who were in the test area during the period of high CO2 concentration, they learned of only one individual's having a headache.

Additionally, Windsor's standard 4-hour in-plant work shift minimized individual exposure. Hence, it appears that the personnel on duty during the last watch, in which the 19,000 parts per million sample was taken and the problem detected, although subjected to the greatest potential health safety hazards, were subject to minimal health effects.

#### ALLEGATION 11

"In the month of June 1979, a high priority job of painting the hull containment building was to be accomplished as Admiral Rickover was to make an inspection of the site. Students were removed from their studies, and all available personnel were instructed to paint. Due to the excessive painting in the hull, the atmospheric contaminant Toluene, a solvent used in paint, exceeded specified limits. No one at the SIC command is even aware this problem existed, and there was no critique held. The toluene concentrations are logged in the Engineering Laboratory Technicians logs. The measured toluene levels were 400 ppm for a half hour time period. The limits are 200 ppm toluene for an 8 hour time period, or between 300 ppm and 500 for a 10 minute time period. This limit was exceeded due to a lack of knowledge on the supervisor's part (Lt. Stevens). Personnel who painted during this time experienced irritation of the eyes, throat and some experienced headaches. When personnel safety is endangered, so is the safe operation of the nuclear power plant. The personnel are an important part of reactor safety, as taught by the Naval Nuclear Power Program."

#### GAO comment

In this case it is alleged that personnel safety was endangered by excessive concentrations of toluene, a paint solvent, when the hull of the Windsor facility containment building was painted in June 1979.

An investigation of this allegation by Windsor facility officials found that the paint contained only trace elements of toluene, and that the device used to detect toluene also detected other paint solvents, including Mineral Spirits 66, which the paint manufacturer identified as the material it uses as a paint solvent agent.

The American Conference of Governmental Industrial Hygienist's 8-hour, time-weighted limit for Toluene atmospheric concentrations is 100 parts per million. There is no specified limit for Mineral Spirits 66; however, Windsor facility records show that the manufacturer's recommended limit is 200 parts per million.

According to Windsor facility records, 44 atmospheric samples were taken over the 2- to 3-day period in which painting was in progress. Windsor facility officials told us that when the detector indicated atmospheric concentrations greater than the Toluene standard, personnel wore respirators approved by the National Institute of Occupational Safety and Health for use in areas with up to 1,000 parts per million of various organic vapors, including Mineral Spirits 66. The respirators would have protected the painters even if concentrations were well above the 400 parts per million reported in Windsor engineering logs. In addition, area ventilation was increased to disperse the paint fumes. Windsor officials maintain that these actions indicate the supervisory personnel were aware of the potential hazards associated with painting. We agree.

We reviewed the Windsor medical records for on-site treatment provided during the period in question. These records show that one person requested medical attention as a result of the painting. The individual sought treatment for nausea thought to have been aggravated by the paint fumes. According to Windsor records, the corpsman sent the individual to a private hospital where medical examination showed the nausea to be caused by influenza. We found no evidence suggesting that the health and safety of the personnel participating in the painting project was endangered.

#### ALLEGATION 12

"In the months of June 1979, on the day Admiral Rickover was due to arrive, another occurrence took place. MM2 Murphy was told by Lt. Mueller to operate valve CL-4. Murphy was told if he did not operate the valve within 5 minutes, the plant would be much harder to recover, and that it would probably be shutdown for 4 or 5 days. A comment was made that

the admiral would not like that. Murphy found the valve in the reactor compartment and it was a highly radioactive valve (greater than 200 mr/hr). The manual for radiological control requires a full containment around this valve to operate it. Murphy made this aware to his supervisors, but was told full containment would take too much time and to simply wrap a rag around the valve while operating it. Murphy reluctantly did this. The potential for the large spread of contamination existed."

#### GAO comment

After investigating this incident, Windsor officials acknowledged that plant supervisors should have used a better procedure, but also said that the procedure actually used was an acceptable one.

The valve in question is an infrequently operated primary system valve with a relatively high surface radiation level. Personnel operating the valve must wear anti-contamination clothing. The valve has a cap capable of withstanding system pressure and containing any leakage past the valve packing. The cap must be removed before the valve can be operated. Before removing the cap, it must be vented by opening a small vent to release any pressure inside the cap. The allegation pertains to the procedure followed in venting the valve cap.

Windsor officials told us the procedure used is acceptable because it would prevent contamination of the individual operating the valve and the local area around the valve. They said, however, that better procedures could have been employed to prevent contamination of the valve. We agree.

#### ALLEGATION 13

"On August 16, 1979, Engineering Test #387 was in progress. CO2 reached and exceeded the specified limits for the test. Senior supervisory personnel, both Navy and General Electric, were made aware. Procedures required the test to be secured. The test was not secured and the procedure was violated. Personnel were ill during and after the test. Since then, investigations performed by the Navy and General Electric have contained lies and deceiving statements regarding the conductance of Engineering Test #387."

#### GAO comment

The events which formed the basis for this allegation were also the events about which the two former instructors

complained to their commanding officer. When they refused to accept the findings of the commanding officer's investigation of their concerns, they were subsequently transferred.

The basic issue in this allegation is whether or not the carbon dioxide levels inside the Windsor facility were high enough to justify stopping a particular facility test in process at the time.

The commanding officer's investigation concluded that during the subject test, one air sample indicated carbon dioxide levels in excess of test procedure limits, but that all previous samples and several immediate backup samples indicated acceptable air quality. The investigation concluded that the one sample, which was well above the limit, was not representative of the area's atmosphere. The investigation included statements from 15 Navy personnel participating in the test, a review of all carbon dioxide concentration measurements recorded during the test, and a review of other logs and records maintained during the test. Except for the two individuals making the complaint, none of the personnel interviewed contended that the carbon dioxide limit had been exceeded during the test. The weight of evidence contained in Windsor facility records indicates that established carbon dioxide limits were not exceeded. We agree.

#### ALLEGATION 14

"In late August 1979, students not qualified as Naval Nuclear Propulsion Plant Operations, were sent into the reactor compartment (an extremely high radiation area) to clean. They were totally unsupervised and had little or no knowledge of working around radiation at the time. Due to the high radiation levels that exist in this area, it is very conceivably possible that the students could have exceeded their legal radiation limits in a short period of time."

#### GAO comment

Windsor facility officials told us that although the students were not qualified as Naval Nuclear Propulsion Plant Operators, all of them had been trained and qualified in radiological controls before they were permitted to enter the reactor compartment. Secondly, they said, procedures require all personnel entering the reactor compartment to be briefed on radiation levels and to wear dosimetry devices while in the compartment. Finally, they said that the students were supervised by a senior chief petty officer who was in the reactor compartment with them for a part of the time.

The maximum Federal radiation exposure limit is 3 rem 1/per calendar quarter and 5 rem per year. We reviewed the exposure records of the four students cleaning in the reactor compartment. The radiation exposures they received (0.008 rem, 0.008 rem, 0.002 rem, and 0.018 rem, respectively) were all significantly below the established Federal limit. The students, therefore, did not exceed their legal radiation limits.

#### ALLEGATION 15

"There is continuing concern over the validity of nuclear welds done at the site. It is entirely possible that a man (civilian) gave up his job at the site due to continual conflict over the validity of radiography work being done. The quality control of welds has often been in question."

#### GAO comment

According to Windsor facility records, two civilian personnel with duties relating to the quality control of welds left the site during the period covered by the allegation. After learning of this allegation, Windsor management investigated their departure and concluded that they left for personal reasons and not as a result of technical concerns over the work which was performed.

We contacted both individuals. One, the former site quality control manager, stated that every primary and secondary system weld was welded and inspected in accordance with Navy standards. He was unaware of the allegation and saw no basis for questioning the quality control over welds. The other, who was the nondestructive testing specialist, was directly responsible for the conduct of radiography and acceptance of weld radiographs based on the requirements in the Navy's standard. He told us that Windsor had a good welding program with high quality controls and that weld radiography was never questioned. The quality control manager worked at Windsor for about 10 years, the nondestructive testing specialist about 15 years. Both stated they left to accept career advancement opportunities.

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1/A rem is the unit measure of ionizing radiation exposure which relates radiation exposure to biological effects. According to DOE Naval Reactors program officials, a typical American receives approximately 1 rem of radiation exposure from natural background sources and medical X-rays over a period of 5 years.

Based on our review of Windsor facility records, and our discussion with the former quality control manager and non-destructive testing specialist, we found no evidence of concern over the quality control of nuclear welds.

#### ALLEGATION 16

"In November 1979, another incident occurred following the pressure testing of a bilge draining system. MM2 Peters could have been seriously injured after a drain plug blew out due to the lack of supervisory responsibility in ensuring the bilge drain system completely depressurized. It should be noted that this was the second time, that we know of, that this has occurred, (refer to violation #3). MM2 Peters has filed a complaint with the Naval Reactors Division of the Department of Energy."

#### GAO comment

This incident was investigated by Windsor facility officials immediately after it occurred. Radioactive materials were not involved in this incident. Although the individual removing the plug was not injured, Windsor facility officials acknowledge that he could have been seriously injured. Their investigation found that maintenance and plant personnel deviated from established procedures governing valve replacement and pressure testing, and were unaware of the potentially serious consequences of their actions. Established procedures were definitely violated.

According to Windsor facility records, the incident occurred during a maintenance shutdown when a pipefitter and his foreman deviated from approved pressure testing procedures without obtaining approval of, or notifying plant supervisory personnel. As a result, a part of the system was inadvertently left pressurized, but plant personnel thought the entire system was depressurized. The next step in the work program was to remove the danger tags from drain plugs and remove the plugs from the drains. When the technician attempted to remove the first plug, it blew out--because the system was still pressurized--and flew into the bilge area overhead. Windsor facility officials acknowledge that the technician could have been seriously injured if he had been struck by the plug. According to Windsor facility records, corrective actions to prevent the reoccurrence of such an incident were initiated immediately, and were completed on April 9, 1980.

ALLEGATION 17

"At this time, the Windsor Nuclear Power Plant is operating with a gagged steam generator relief valve. It did not pass the safety inspection. Approximately 4 months ago, all primary and secondary system relief valves were tested and a great deal of problems arose. There is a question in our minds as to whether any of these relief valves may still have problems, as many questionable events surrounded the testing. The relief valves drifted from their established set points, some stuck when opened and some would not fully reset."

GAO comment

According to Windsor's preventive maintenance requirements, primary system valves and steam generator relief valves must be tested every 5 years. In August 1979, these tests were conducted. All valves were tested, adjusted, and retested until they operated within specifications. The following sections discuss separately the circumstance surrounding the primary and secondary system tests.

According to Windsor facility records, all the primary system valves lifted and reseated within specifications after minor adjustments to set pressure. One valve, however, leaked about 12 gallons a day, which far exceeds the design specification. Windsor facility officials maintain, however, that this volume of leakage neither affected the functioning of the valve, nor presented an operational problem. On the other hand, they said experience shows that such leaks usually get worse. The matter was evaluated by General Electric, which recommended that DOE approve deferring replacement of the valve until the next scheduled maintenance shutdown. On August 30, 1979, DOE approved operating the plant until the valve could be replaced during a scheduled maintenance shutdown. Windsor facility records show that the valve was replaced and tested satisfactorily during the November 1979 scheduled maintenance period.

According to Windsor facility records, after minor adjustments to set pressure, all the steam generator relief valves lifted and reseated within specifications when tested in August 1979. One valve, however, opened slowly and was estimated to function below design capacity. Further analysis showed that a valve operating at this lower capacity would still supply sufficient relief capacity, providing at least one of the remaining valves was operating at its design capacity. Therefore, Windsor officials concluded in October 1979, that this valve could still be used and the plant operated within established safety criteria.

Windsor facility records also show that the valve which opened slowly was replaced during the November 1979 scheduled maintenance shutdown. It operated satisfactorily when tested, but when resealed, it leaked excessively. Windsor facility records show that on November 24, 1979, this valve was removed from service. On January 17, 1980, the valve was replaced and the new valve passed all the required tests.

According to Windsor facility records, the plant at no time operated with less than the required number of fully operational steam generator valves. The presence of additional steam generator valves above those required for normal operations is a design redundancy intended to permit continued plant operations in the event of malfunctions. We found no evidence that either primary system or steam generator relief valves operated improperly. Nor did we find anything questionable about the events surrounding their testing.

#### CONCLUSIONS

We investigated the 17 alleged violations of radiological and industrial safety and health procedures and standards to determine if they were accurate and, if so, if dangerous or potentially dangerous conditions existed at the Windsor facility. For many of the allegations, we found that the specific events which formed the bases of the allegations were undisputed. For example, Windsor officials agreed that the primary system valve referred to in allegation 1 (see p. 2) leaked as alleged. At issue in these cases, was the significance of the events and whether or not the events constituted one or more violations of established procedures and/or standards; that is, did the leakage from the primary system valve referred to above constitute a violation of established standards, and was the leak potentially hazardous to Windsor facility personnel?

We found that violations of established procedures and/or standards occurred in 5 of the 17 allegations. One of these five violations--the unauthorized deviation from procedures for testing one of the bilge drain systems--had the potential for a serious personnel injury. None of the other four violations were indicative of, nor resulted in, actual or potentially dangerous conditions. Each of the five cases was investigated and corrective actions taken by DCE Naval Reactors' officials and Windsor facility management either immediately after the events occurred, or as soon as they were made aware of the specific allegations. The events forming the basis for

the other 12 allegations did not violate established procedures nor did they constitute actual or potentially dangerous conditions at the Windsor facility.





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