The second type of crack, a crater crack, is a small, shallow surface discrepancy. DOE/WEP determined that it is possible to fuse the defective area by welding over a crater crack.

In addition to the engineering evaluation, DOE/WEP examined 236 structural welds in the valve rooms. This is the same set of visual and ultrasonic examinations discussed previously. The examinations showed 190 of the welds to be acceptable. The remaining 46 welds required engineering evaluation to determine acceptability. The TVA analysis, with DOE/WEP concurrence, showed the welds to be suitable for service.

The ERT raised additional issues during their evaluation of the employee concerns.

In one of the issues, ERT concludes that the occurrence of cracks in the structural steel was not identified and dispositioned as a nonconformance; and that the repair of the cracks was not approved by the responsible design organization. Cracks are defined in the investigation report as "crack, lamellar tear, linear indication, or similar defect in the base material".

The ERT investigation identified 21 work releases prepared for crack repairs in base material during 1983 and 1984. During the period in question, several nonconforming condition reports were open. These NCRs applied to the structural steel addressed by the ERT investigation report.

The TVA response to the ERT report states that the "cracks" were actually laminations, mill marks, and lamellar tears. Delamination (opening of a lamination) and lamellar tears are processing defects associated with welding of the structures.

The linear defects in question were associated with the repair welding mandated by the nonconforming condition reports. As such, the repairs were appropriately treated as inprocess defects, controlled by the existing dispositions. In that the engineering approved dispositions specifically addressed repair of linear indications, and work packages were issued as noted in the ERT report, engineering approval for the repairs did occur.

One ERT interim investigation report draws a conclusion that an indeterminate condition exists as to how many welds that were designed as full penetration welds are not actually full penetration.

Three nonconforming condition reports addressed all of the subject welds. The dispositions to these NCRs required that all deviant weld configurations be referred to the engineer for evaluation. The welds would then be evaluated in the as-constructed condition, and accepted as is or reworked. The inspectors were tasked to verify the as-constructed depth of penetration. The results were then analyzed by the design organization. Where conditions other than as-designed were accepted as is, Engineering Change Notices or Field Change Requests were issued to change the drawings.

The nonconforming condition reports do not specifically show a listing of each item affected, the reinspection findings, or the disposition to these findings. The documentation packages for the steel do contain this information, and the NCR numbers are referenced on the documents. The evaluation revealed evidence that where full joint penetration was specified but not attained, the conditions were identified. The drawings were revised as appropriate in accordance with the dispositions to the nonconformances. Thus, Engineering disposition of the nonconforming conditions did take place.

Complete details of the evaluation of these issues are discussed in Weld Project Evaluation Report WP-34-WBN.

Weld Joints Slugged or Improperly Beveled

Five employee concerns raise issues dealing with slugs (solid metal objects) placed in joint grooves prior to welding; and with pipe ends being beveled improperly prior to welding. The issues raised by the concerns relate to safety related and nonsafety-related applications at Watts Bar Nuclear Plant. Three of the concerns were previously investigated by DOE/WEP and/or ERT.

Two of these concerns relate to steel rod slugs placed in the groove of a weld on a Main Steam Jet Impingement Sleeve.

The concerns are factual. ERT investigation of this issue resulted in the initiation of a nonconforming condition report. The Welding Project evaluation led to the issue of a Corrective Action Tracking Document.

ERT verified by visual examination that one of the girth welds in the restraint had a cold rolled steel slug embedded in the weld. ERT also reported a lack of penetration into the girth and longitudinal welds; slag residue from flame cutting and arc welding; and a root opening (distance between the abutting members) which exceeded the drawing requirement.

Based on a document review, ERT also determined that one of the welders was not qualified for the work performed. The ERT report states that the welder was qualified only for welding with a backing ring, and the work in question was an open root butt joint.

TVA initiated a nonconforming condition report (NCR) to address the slugged weld. Ultrasonic examination of the weld established the exact extent of the deficiency. Engineering calculations were performed, and showed the slugged weld to be suitable for service.

The TVA NCR and the engineering calculations did not, however, address the lack of penetrations of the girth and longitudinal welds; the slag entrapped in the root of the welds; the increased root opening; or the welder's qualification for the work performed.

Welding Project identified the welders who performed this work, reviewed their qualifications, and established that they were properly qualified for the work performed.

Welding Project visually examined 6 to 10 inches of accessible weld areas on three longitudinal welds.

Of the areas examined, the welds displayed no visible weld penetration into the roots of the joints. The sleeve sections were abutted with no visible root opening in the areas examined. The excessive root opening noted in the ERT findings did not appear in the longitudinal welds. The abutting longitudinal welds are aligned, where the design drawing shows them to be rotated 90 degrees from each other. In the areas examined, slag was not found.

Corrective Action Tracking Document 50444-WBN-01 was initiated to ensure that the weld discrepancies omitted from the TVA NCR are evaluated and, if necessary, corrected. The corrective action plan provides for the identified conditions to be investigated as part of the overall Watts Bar welding evaluation. Any adverse condition identified will be reported and processed in accordance with the applicable procedure for conditions adverse to quality.

One employee concern states that some welds were slugged in the Turbine Building in 1976. DOE/WEP requested additional details from ERT, and learned that no further information was available. DOE/WEP, therefore, elected to address the concern through the results of the General Plant Examinations. The results of these examinations do not support factuality of the concern.

The DOE/WEP examinations were performed on statistically valid samples of the safety-related large bore piping welds, small bore piping welds, and structural welds at Watts Bar. The general examinations included all of the recreatable visual and nondestructive examination criteria imposed by the applicable engineering drawings.

In some of the populations, the visual examination criteria provided by the Nuclear Construction Issues Group standard NCIG-01 was used. The general plant examinations did not reveal any instances of slugged welds.

In an unrelated issue, DOE/WEP reviewed the radiographs for 3,064 TVA welds at Watts Bar. While this effort was not intended to address the concern relating to slugged welds, the results can be applied to the issue of concern. None of the radiographs showed slugs in the weld joints.

One employee concern states that a seam weld on a box anchor was slugged by placing reinforcing steel in the seam and covering it with weld filler material. This concern is not factual.

The concern identified a specific system, area, and elevation in the Unit 1 Auxiliary Building. DOE/WEP reviewed the TVA design drawings to identify all of the box anchor supports at the elevation specified by the concern. A walkdown of these supports eliminated all but two based on location or configuration.

DOE/WEP performed visual and ultrasonic examination of the seam welds on the two identified supports. These examinations did not identify a condition relating to the welds being slugged.

Two concerns relate to welds being made with square butt groove joints used rather than the design specified single vee groove joints.

One of the concerns states in part that butt welds were substituted for full penetration welds in the Turbine Building in 1976. No further details were available. Factuality of this concern was not conclusively proved or disproved. The evaluation did not develop any evidence to support factuality.

A review of the deficiency reporting history for the first ten years of construction at WBN did not reveal any instances where square butt preparations were substituted for bevel or vee grooves. Discussion with cognizant TVA personnel also failed to provide any indication that such an improper substitution may have occurred.

During the period in question, the WBN site procedures required the Welding Engineering Unit to ensure that all welding was performed in accordance with the TVA Process Specifications. This was accomplished in part through a general welding surveillance which was conducted on a daily basis, and documented on a weekly report. All construction areas, including the Turbine Building, were encompassed by the surveillance program.

Review of the Welding Surveillance Weekly Checklists for the time period in question produced no indication that welds were identified as being made with improper joint geometries.

The results of the radiographic review discussed above may also be applied to this issue. A square butt joint configuration used where a vee or bevel groove is expected would be readily apparent when viewed on radiographic film. The review of all TVA performed radiographic examinations did not identify this condition.

In June 1982, DNE issued a nonconformance report to resolve a drawing discrepancy which may have led to this concern. Four pipe support drawings incorrectly specified fillet welds to attach lugs to the piping. The requirement was to attach these lugs using full penetration welds. It is possible that this nonconformance is the root of the concern.

One of the concerns states that Fire Protection System Piping has been improperly welded. DOE/WEP requested further information from ERT. The response showed the material issue of concern to be that square butt groove joints were used rather than the design specified single vee groove joints in the Fire Protection System in Diesel Generator Building Number 5.

DOE/WEP identified twelve butt joints in the area bounded by the concern. Based on the population size, the DOE/WEP sampling practice dictated that all of these welds be inspected.

Lack of penetration would be the most probable indicator that a square butt rather than a vee groove joint existed. Ultrasonic examination of the twelve welds showed that no lack of penetration was present in any of the twelve welds. Therefore, the concern was not factual.

One employee concern states in part that two apprentice welders were directed to weld a joint which had been slugged with steel rod.

The issue of directing employees to perform work improperly has been assigned to the Office of the Inspector General under Subcategory 60100, and is not discussed further in this evaluation. The technical issue raised by the employee concern is addressed in the above discussion of the Main Steam Impingement Sleeve.

Complete details of the evaluation of these issues are discussed in Weld Project Evaluation Report WP-44-WBN.

Nuclear Steam Supply System Support Welds

Six employee concerns raise issues dealing with safety-related Nuclear Steam Supply System supports at WBN. These concerns were investigated by DOE/WEP and/or ERT.

Two employee concerns state that the steam generator support welds and the attachment welds to embedded plates were not preheated prior to welding. Examination of the welds by DOE/WEP did not confirm these concerns.

The most probable defect to result from a lack of preheat would be cracking in the root of the welds. DOE/WEP performed visual and ultrasonic examinations on a sample of seventy steam generator support welds. The ultrasonic examinations did not reveal any cracking at or near the weld roots.

While failure to adequately preheat a heavy section thickness prior to welding might lead to cracking in or near the weld root, it is also possible that a crack would not occur. The preheat temperature is specified by the Detail Welding Procedures, but documented verification of the preheat is not required for structural items. Therefore, it is not possible to conclusively prove or disprove the factuality of the concerns. The results of the DOE/WEP ultrasonic examinations, however, provide adequate confidence that if these violations did occur, they did not result in an adverse hardware condition.

One employee concern states that welders were instructed to weld over possibly defective steam generator support welds to make them "look" acceptable. Another concern states that the trusses under the steam generators may have been improperly welded. Examinations performed by DOE/WEP did not confirm these concerns.

The two concerns were evaluated by DOE/WEP through a random sample in which magnetic particle examinations were performed on thirty-one steam generator support welds.

Twenty-eight of the welds were accepted by the magnetic particle examination process. Two of the welds displayed surface indications which required exploratory grinding to determine their acceptability. One weld required surface preparation for the examination. Acceptable magnetic particle examination results were obtained.

Whether or not a Foreman actually told the craftsmen to weld over uncorrected defects cannot be conclusively proved or disproved. However, the DOE/WEP examination results indicate that if such a directive was issued, it was not followed.

One employee concern states that there is a probability of trapped slag in the steam generator support welds. After examination of a random sample of seventy of these welds, DOE/WEP concluded that the issue raised by the concern was not confirmed.

These examinations did reveal some deviations from the DOE/WEP acceptance standards. None of the examinations, however, identified slag entrapped in the welds. The welds which displayed deviant conditions were shown by engineering analysis to be suitable for service without rework.

One employee concern states that the Unit 1 and 2 reactor vessels inside the cavity wall and the T-Bar shims exhibit cracks. Additional information provided by ERT showed that the items in question are actually the cold and hot leg motion restraints (T Bars) on the Reactor Coolant System Loops 3 and 4. The Concerned Individual did not intend the concern to apply to the vessels. The concern is partially factual. It does not, however, represent a problem.

DOE/WEP evaluated this issue for Unit 1 only. For Unit 2, the issue remains open. A Corrective Action Tracking Document (CATD) has been initiated to ensure that the Unit 2 portion of the concern is adequately addressed.

DOE/WEP performed a visual examination of all accessible welds on the T-Bars in Unit 1, Loops 3 and 4. Thirty-five welds were examined.

Cracks were noted on unspecified alignment tack welds. These tack welds are not part of the restraint, and are not load bearing. They were used solely as an alignment tool during construction. Therefore, the cracked tack welds have no detrimental effect on the intended function of the restraint.

Welding Project considers the issue closed for Unit 1. CATD 50400-WBN-02 will provide the necessary followup to ensure inspection and closure for Unit 2. The corrective action plan states that this concern will be included by the TVA Weld Task Group in the Unit 2 weld evaluation program.

One Concerned Individual observed a crack in a Unit 1 steam generator restraint. At the time of the observation, the weld had not been completed. The concern is factual. The problem, however, was identified and corrected by the Quality Assurance Program at WBN.

In investigating this issue, ERT noted that a nonconforming condition report and its associated Field Change Requests and Work Package had identified and corrected the discontinuity.

Complete details of the evaluation of these issues are discussed in Weld Project Evaluation Report WP-45-WBN.

General Welding Concerns Related to Unit 1, Units 1 and 2, and Common Areas

Thirty-one employee concerns deal with the quality of welds in various safety and nonsafety-related applications at Watts Bar Nuclear Plant.

Three of the concerns relate to welds being left partially completed rather than being welded to the required size or section thickness. Two of these concerns were investigated by DOE/WEP, and one was investigated by ERT.

One concern states that the Concerned Individual (CI) completed four of eight welds on six inch check valves in the Fire Protection System. The CI stated that only the root was completed in the remaining four welds. The statement of concern, i.e., that the CI did not complete the welds, may be factual. The material issue of concern, however, is whether or not the welds have been completed. In this respect, the concern is not factual.

A visual examination was performed by DOE/WEP on the installation welds for all safety-related six inch check valves in the Unit 1 Fire Protection System. None of the welds had been left incomplete.

One concern states that a Fire Protection System weld is incomplete. This concern is factual. TVA independently identified the problem at approximately the same time the concern was expressed to ERT.

Visual examination by ERT revealed that the weld surface was lower than the base metal surface. During the investigation, ERT found that TVA was aware of the problem, and had issued a Work Release to remove the coating to allow inspection of a potentially defective weld. A second Work Release was issued to authorize the inspection and any required rework. TVA initiated a nonconforming condition report to document the deficiency. The weld was reworked with acceptable visual examination results. The NCR was closed in March 1986.

One of the concerns states that there is a 12 inch diameter pipe attached to a 36 inch pipe in the Turbine Building with no caps on the welds. The system identification was known to ERT, but was withheld when the Employee Concern Assignment Request Sheet was initiated. The CI did not provide any additional information.

In that the weld in question is in the Turbine Building, it is not classified as a safety-related weld. The concern was considered by DOE/WEP in the General Plant Examinations only for a possible generic implication toward safety-related welds. These examinations did not include the Turbine Building piping. They were, however, statistically valid samples from which conclusions may be applied toward unsampled like items.

The DOE/WEP evaluation of the concern is based on the results of the general examinations performed for piping welds. Welding Project reviewed the results of the DOE/WEP General Examination Groups which address large bore welds. DOE/WEP reported deviant welds in each of these groups. None of the deviations, however, related to missing or incomplete large bore piping welds. It is, therefore, unlikely that the 12 inch welds referred to in the concern were left uncompleted.

Two employee concerns relate to the preheat and interpass temperature requirements specified by the Detail Weld Procedures not being implemented.

One of the concerns states that the preheat was not adequate for welding of the 500KV bus bars in the switchyard. The concern states that the welding was performed in cold weather between 1975 and 1978. The factuality of this concern cannot be conclusively established.

There are no safety-related welds associated with the bus bars in the switchyard. Therefore, Quality Control verification of the preheat cannot be obtained from a document review.

Review of the Welding Surveillance Weekly Checklists revealed that for the yard areas, the features observed were in most cases identified. Electrical welding in the switchyard was specifically identified on many of the surveillance reports from March 1976 to January 1978. These reports did not identify any procedure violations relating to welding performed on the bus bars.

The specified preheat from the Detail Weld Procedures for aluminum welding is 60 degrees. Discussion with a cognizant TVA Welding Engineer revealed that during cold weather, flame torches were used to attain the 60 degree preheat. This is one of the methods approved by the TVA process specifications.

In that preheat prior to welding was not a Quality Control hold point for this work, it is not possible to positively state that the preheat for the bus bars was adequate for every weld made. It has, however, been established that TVA at Watts Bar had an adequate program in place to specify the preheat temperature; that compliance with this program was the subject of routine surveillance; that the hardware in question was specifically identified on the surveillance reports; and that the surveillance program did not identify any instances to support the factuality of the concern.

Therefore, Welding Project concludes that if the concern is factual, it represents an isolated occurrence of individual failure to comply with the Detail Welding Procedure(s) on a nonsafety-related item.

One concern states that Ironworker and Sheet Metal General Foremen "supposedly" ordered welders who were working on stainless steel to ignore interpass temperature requirements.

When DOE/WEP requested further details, the ERT response gave no specifics, and noted that the statement of concern was based on hearsay which occurred several years before the concern was lodged. It is, therefore, not possible to determine the factuality of the concern. If the concern is factual, it is improbable that any adverse hardware effect resulted.

DOE/WEP has performed an indepth study of the probable effects of failure to control maximum interpass temperature when welding stainless steel. This study shows that elevated interpass temperatures have minimal effect on the mechanical properties of the stainless steels commonly used at WBN. From the metallurgical point of view, three elements are required to induce stress corrosion cracking; sensitization of the steel, caused by the elevated temperature; a chemical environment which promotes stress cracking in the sensitized steel; and tensile stress associated with the service of the component.

The concern specifically relates to two crafts: Ironworkers and Sheet Metal Workers. The Ironworkers craft did not fabricate or install any of the components for service in which the chemical environment necessary to promote stress corrosion cracking is present.

The Sheet Metal craft is generally not concerned with interpass temperatures. Interpass temperature control is a function of allowing the weldment to cool after completion of a full pass (layer of weld metal), prior to beginning of the next pass. Most sheet metal welding is completed in a single pass. The section thickness of sheet metal is too small to support a weld size which requires multi-pass deposits. Also, the chemical environment necessary to promote stress corrosion cracking is not present in the items fabricated or installed by the Sheet Metal workers.

One employee concern raises two issues. These issues relate to excessive removal of metal when preparing stainless steel butt joints for nondestructive examination; and excessive shrinkage in stainless steel circumferential butt joints.

The concern states that stainless steel welds seem to have excess metal removed at butt joints. This part of the concern is not factual when applied to WBN Unit 1. A Corrective Action Tracking Document has been initiated to resolve the issue for Unit 2.

DOE/WEP requested additional information to aid in the Unit 1 investigation. The ERT response identified the welds in question as 16 inch piping attached to the Residual Heat Removal (RHR) System pumps at elevation 692. The response further indicated that the base metal thickness was reduced during preparation for preservice inspection.

DOE/WEP identified the welds bounded by the details of the concern. Two 14 inch stainless steel pipe welds attached to the RHR pumps were made by TVA. DOE/WEP performed visual and ultrasonic examinations of the weld joints. Additionally, DOE/WEP reviewed the original radiographic film for each weld. These examinations and reviews produced acceptable results for the piping and associated welds.

Corrective Action Tracking Document 50400-WBN-08 addresses this issue for Unit 2. The corrective action plan provides for inclusion of this issue in the Unit 2 weld evaluation program.

This concern also states that "Welds exhibit excessive shrinkage at joints". The Concerned Individual stated that he had examples, but that the concern was generic throughout the plant. The examples are the welds discussed above. No additional details were provided. The material issue of concern is the circumferential shrinkage which occurs at welded butt joints in stainless steel piping.

Some basis exists for the observation, in that this shrinkage, inherent in stainless steel welds, is more readily apparent in girth butt joints than in other weld geometries. In characterizing the shrinkage as excessive, however, the concern is not factual.

There is no code, standard or specification requirement outlining criteria for the acceptance or rejection of shrinkage at stainless steel butt joints.

The TVA Detail Weld Procedures, based on sound construction engineering evaluation and judgement, limit the heat input to control and minimize distortion and shrinkage in stainless steel welded butt joints. The Detail Weld Procedures for use on stainless steel limit the current input based on filler material size, and establish maximum allowable interpass temperatures.

One employee concern raises the issue that grinding in surface preparation for radiography may have caused section thickness violations. In question are the welds joining piping to the containment shield wall penetrations. The concern is factual.

To resolve this concern, DOE/WEP selected a sample of 52 welds for ultrasonic thickness measurement. The examinations resulted in 15 of the welds reported as deviant, and requiring engineering analysis to determine their acceptability. The TVA analysis showed all of the welds to be suitable for service. Based on the percentage of welds deviant, DOE/WEP performed a generic problem analysis. This analysis established that there are no generic problems associated with the unsampled welds in the population.

Four concerns state that until recently, TVA Welding Inspectors required all pipe welds to be ground to a smooth finish. The material issue of concern is that smooth grinding is not required by the construction codes and may mask surface defects which would otherwise be detectable. While grinding to a smooth finish is often required, the issue of concern is not factual.

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code requires the surfaces of welds to be sufficiently free from coarse ripples, grooves, overlaps, and abrupt ridges and valleys for proper interpretation of radiographic and other required nondestructive examinations (NDE) of the welds. If the weld surface requires grinding, care must be taken not to reduce the weld or base material below the required thickness. Also, when weld surface defects have been detected, the ASME Code states that "weld metal surface defects shall be removed by grinding or machining".

The extent of surface preparation required is dependent on the NDE process specified for the weld. Generally, a smoother finish (thus more preparation by grinding or polishing) is required for the volumetric examination processes than for surface examinations.

The methods used in nuclear construction, including at WBN, for surface preparation of piping welds do not mask indications, rather, they often remove minor surface defects which might otherwise be cause for rejection of the weld. This is not only an acceptable practice, but a desirable one.

The requirements for surface finishing of piping welds have been detailed in the site implementing procedures, either directly or by reference to the TVA process specifications from the beginning of construction.

One employee concern states that the pipe specification for piping on the Post Accident Sampling Deck calls for open butt welds; that welds were made using a backing strap; that the Concerned Individual was not aware of any specification changes; and that the individual was concerned about entrapment of contaminants. DOE/WEP requested additional details. The ERT response indicated that the Concerned Individual would give no more information.

The concern is not factual, in that the TVA specifications and site implementing procedures do allow the use of backing rings for welded butt joints in piping.

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code, establishes the rules for use of backing rings, including whether or not the rings must be removed after welding.

For Class 1 pipe welds, the backing ring must be removed after welding. Backing rings need only be removed from ASME Class 2 butt joints when their remaining in place will result in undesirable conditions such as severe stress concentration, corrosion, or erosion. Backing rings, when used in ASME Class 3 butt joints, may remain in place.

The TVA process specifications and site implementing procedures provide adequate controls to ensure that the ASME Code requirements relating to backing rings are satisfied.

DOE/WEP reviewed 3,064 TVA radiographs for Watts Bar. While the review was not specifically intended to address this concern, the results can be applied to the issue of concern. Of the radiographs reviewed, 233 were rejected for indications in the welds beyond code acceptable standards. None of these deviations related to unspecified use of backing rings.

Additionally, a fitup inspection is required for all safety-related pipe welds at WBN. The fitup examination is performed after the joint is tack welded into position, but prior to the root (first) welding pass. Therefore, if a backing ring was installed in a joint for which the assigned welding procedure specified open root welding, it would be readily apparent to the Welding Inspector. Such a condition would be rejected and corrected before the weld was made.

One employee concern states that the ice deck seal stud welds did not meet the visual inspection criteria; and that when notified of this fact, the shift QC Supervisor waived the visual weld inspection requirement and allowed the work to proceed. This concern is not factual.

ERT retrieved and reviewed the documentation for the Ice Condenser Seal. The review established that all of the required inspections were performed and documented. ERT reported that there was no evidence to indicate that the QC Supervisor waived the inspections required.

This issue was also addressed by a nonconforming condition report in August 1979. The studs for the Ice Condenser end wall access doors did not meet the visual inspection criteria, in that some of the welds did not create a fillet extending the full 360 degrees around the studs. The disposition invoked a mechanical testing requirement rather than visual inspection to ensure the integrity of the studs. This mechanical test was performed in accordance with The American Welding Society Structural Welding Code, AWS D1.1, 1979 Edition.

It is possible that the Concerned Individual was unaware of the nonconforming condition report, and viewed the application of a mechanical test rather than a visual weld inspection as an improper waiver of requirements by the Quality Control Supervisor.

One employee concern states that during 1977 and 1978, welding was performed on the Unit 1 Residual Heat Removal System while sandblasting was in process in the area. The issue of concern is the possibility that dirt and dust from the sandblasting may have contaminated the welds. The statement of concern is presumed to be factual. The material issue of concern, however, is not factual.

The problem description given in the text of the concern shows that the sandblasting operation was on the Unit 1 containment liner plates. The residues to be considered are sand particles and iron oxide (from surface rust on the plates).

The airborne sand residue resulting from a sandblasting operation is very fine particulate matter, whose texture more nearly resembles dust or powder than sand. These particles are silicates, which are refractory (high melting point) materials.

Due to the low density (very fine particles) of the sand dust, the forces of the electric welding arc and the shielding gases would prevent most of the particles from entering into contact with the weld puddle. Any of this material which actually comes in contact with the surface of the weld puddle will become part of the slag because of its lower density.

In that the sand residue is a silicate, the melting temperature is significantly higher than that of the metal being welded. The fluxing components in the weld filler material form silicates very similar in makeup to the sand dust. The dust particles would join with the silicates formed by the fluxing agents. The effervescence, which occurs in the molten metal during welding, brings the silicates and other naturally occurring contaminants to the weld surface in the form of welding slag. In shielded metal arc welding, this is seen as the typical slag layer which hardens as the weld cools, and is removed by chipping and brushing. In gas tungsten arc welding this is seen as a thin, translucent layer of silicate material on the weld surface. This thin layer is removed by brushing. It is important to note that this process is inherent in the welding operation, and the introduction of additional fine particles of the refractory silicate which forms the sand dust has no appreciable effect on the weld.

The sandblasting operation would also produce airborne particles of rust. These particles would be of the same fine, dustlike form as the sand particles discussed above. Again, the forces of the welding arc and the shielding gases would mechanically exclude most of the dust from the weld. If any of the rust were to enter into contact with the weld pudd[illegible] it would be in the form of iron oxide.

The weld filler materials contain deoxidizing agents. These agents combine with the oxides which occur in the base metal, and remove them to the surface of the weld. Gases created during this process are released through the molten slag layer. Solids are contained in the slag layer, which solidifies at the surface and is mechanically removed. Fine particles of rust introduced into the weld puddle in the form of iron oxide would join this already occurring deoxidizing process, and be removed with the existing oxides.

One concern states that Welding Engineering decided to remove the Astro-Arc welding machines from the field when four randomly selected welds failed radiographic examination; that the welds are in the Turbine Building; that Welding Engineering stated that all Astro-Arc welders were to be removed from the field; that all Astro-Arc welds would have to be repaired or reworked; that none of the welds have been repaired or reworked; and that the (Astro) machines were returned to service after two to three months. The statement of concern is factual. It does not, however, represent a problem.

The Astro-Arc welding machine is used for automatic gas tungsten arc welding of small bore pipe joints. The joint is held in its fitup position by a mechanical fixture. The welding head, which mounts the tungsten electrode, is clamped around the joint. Rotation of the welding head around the joint is automatically governed through an electro-mechanical control system.

In 1978, the welding operators began to experience a high rejection rate for the Astro-Arc welds. The four welds noted in the concern were part of a sample examined in a Welding Engineering Unit (WEU) effort to isolate the cause of the high reject rate. The radiographic examinations were an expedient method for the Engineer to fully characterize the [illegible]. Radiographic examination was not a required installation inspection for these welds. It should also be noted that the remainder of the sample, 15 welds, produced acceptable radiographs.

The cause of the problem was identified as worn parts in the rotating welding head. The equipment was removed from service until such time as replacement parts could be procured, installed, and tested. It was not the intention of the Welding Engineer to permanently discontinue use of the Astro-Arc welding machines. They were repaired and returned to service as planned.

The four welds which exhibited a lack of full weld penetration to the root of the joint are nonsafety-related welds. The integrity of these welds was judged acceptable based on the hydrostatic leak test (nondestructive examination was not required). This is an acceptable practice in accordance with the Power Piping Code, ANSI B31.1.

In a response to ERT, made when the concerns was lodged, the WEU supervisor noted that the statement that all Astro-Arc welds would require repair or rework was made prematurely by a member of the WEU. The engineering evaluation of the problem showed that rework of the completed welds was not required.

One employee concern states that the welds joining weldolets to a header pipe in the Fire Protection System have insufficient weld metal. This concern is factual. It does not, however, represent a problem.

The text of the concern provided a specific location in the Unit 1 Control Building. DOE/WEP identified the welds from the location given and the design drawing. Visual examination by DOE/WEP confirmed that the two welds in question had areas which were underfilled.

TVA performed an engineering analysis of the reported deviations. The analysis showed the welds to be suitable for service. DOE/WEP reviewed and concurred with the TVA analysis.

One concern states that deterioration of metal, lack of penetration, and sugar (oxidation) exist in stainless steel welds in the Essential Raw Cooling Water System. This concern is not factual.

DOE/WEP assessed this concern through an engineering study and examination of the subject welds. Relative to deterioration of the base metal, DOE/WEP determined that the issue of concern was the possibility of overheating caused by exceeding the specified maximum interpass temperature during welding.

DOE/WEP performed an engineering study to determine the effects of welding with interpass temperatures above 350 degrees Fahrenheit (350°F). This study considered types 304 and 316 austenitic stainless steels. The welds in question are in a system whose stainless steel piping is type 304, and are therefore addressed by the study.

The DOE/WEP study, which consisted of an extensive literature search, shows that no deterioration of the base steel in the ERCW System would result from exceeding the maximum interpass temperature specified by the TVA Detail Weld Procedures. Where the TVA procedures specify a maximum interpass temperature of 350°F, the DOE/WEP study shows that interpass temperatures up to 705°F have no appreciable effect on the microstructure, weld soundness, transverse strength, or weld metal or heat affected zone toughness in the type steels studied.

To assess the lack of penetration and weld root oxidation (sugaring) which might have occurred due to loss of the inert gas purge, DOE/WEP performed visual, liquid penetrant, and ultrasonic examinations of the welds. Based on information given in the text of the concern and review of the design drawing, DOE/WEP isolated the problem area to 26 welded pipe joints.

Lack of weld penetration is the most probable defect to result from oxidation at the weld root. The ultrasonic examinations performed by DOE/WEP established that full penetrations were attained on all of the welds. DOE/WEP concluded that no sugaring of the welds is expected, because no lack of penetration was detected.

One employee concern states that reworked hardware has no higher quality than the original work, and in some cases the quality is lower, although still acceptable. The concern notes that most of the rework is done because of inadequate paperwork. Examples given are rework of good welds so the inspector can see the fitup; and pull testing of noncritical inserts that "could not possibly pull out".

The statement of concern is partially factual, in that reworked hardware, while meeting all of the quality assurance requirements, may sometimes display acceptable indications which were not present on the original work. This is not a technical problem, since the reworked item must meet the inspection acceptance criteria.

The nonconforming condition reporting history at WBN shows a number of cases where hardware was reworked due to bypassed Quality Control hold points or lost process control documentation. Where it is not possible to reconstruct the weld history from other related documents, there is often no choice but to replace the weld. Documentary evidence to verify compliance with the code mandated requirements is essential in welding under the ASME Code.

Proof testing of concrete anchors is part of the Quality Assurance Program at Watts Bar. These tests are applicable to all Category I structures. Thus, noncritical (presumed to mean nonsafety-related) items installed in safety-related structures are subject to the controls of the testing program. Samples are selected for testing according to a schedule of quantities defined by the site implementing procedure. The selected anchors are hydraulically tensioned to a proofload based on the bolt material and diameter.

The Concerned Individual's premise that these anchors could not possibly pull out is incorrect. One example of the importance of this testing program is evidenced by a case wherein a vendor notified TVA of a manufacturing deficiency in a certain type of concrete anchor. TVA had received a large quantity of these anchors, and most had already been installed.

Had the vendor not discovered the defect, the TVA testing program would have. For the size of anchors in question, the failure rate during testing, prior to receipt of the suspect lot, was less than one percent. After receipt of the suspect anchors, the failure rate increased sharply. Eventually, the failure rate for these anchors rose to 35 percent. Rather than an unnecessary destructive test, the TVA program for tension testing of concrete anchors is an important part of the Quality Assurance Program.

The Employee Response Team initiated a concern which states that due to a physical impairment, welds made by a specific individual may be inadequate. No further details were made available.

The welder qualification program at Watts Bar is defined by a Quality Control Instruction which meets the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code and the American Welding Society Structural Welding Code.

Each of these construction codes states that the performance qualification test is to determine the ability of the welder to deposit sound weld metal. Therefore, when the welder in question successfully completed the performance qualification testing process, he was qualified within the limits imposed by the test taken.

There is no reason to suspect that a welder with a physical impairment should produce substandard work if that work is assigned based on his/her performance qualification tests, and with consideration of the impairment relative to the work at hand.

One employee concern states that the couplings on the instrumentation sensing lines in the Reactor Coolant System may have been improperly fitup, and that this may have caused the lines to "kink".

The concern is partially factual, in that some of the subject instrumentation lines were deformed (kinked). It is, however, unlikely that improper fitup for welding caused the damage.

ERT investigated this concern. At the time of the ERT investigation, the instrumentation sensing lines in question were in the process of being replaced. ERT performed a walkdown of the system, and noted that some of the lines which had not yet been replaced were kinked. The walkdown also identified "excessive angularity" at some of the coupling connections. The investigation report states that the exact reason that the lines kinked could not be determined.

The excessive angularity noted by ERT is probably mechanical damage caused by ongoing construction activities. The same logic holds true for the kinks found in the lines. This is a common problem in power construction. Damage to instrumentation sensing lines is usually caused by heavier materials being rested or dropped on the lines, or by personnel stepping on them.

A complete evaluation of all instrumentation lines is presented in Construction Subcategory Report 17300.

One employee concern states that the stainless steel shield surrounding the reactor had some bad welds. The concern specifically cites porosity as the problem.

Additional information provided by the CI through ERT indicated that the welds are located in the refueling pit; were made by the Ironworker craft; were made before the Reactor Building dome was placed; and that the welds were made while it was raining.

Based on the work being performed by the Ironworkers prior to the dome being placed, DOE/WEP was able to isolate the area of concern to the embedded plates and supporting structures for the stainless steel refueling pool liner. In that the welds are embedded in concrete and the liner plates are installed, this work is physically inaccessible for reinspection.

DOE/WEP reviewed the inspection records for the inaccessible welds, and found no indication that TVA had encountered problems with excessive porosity in the welds. DOE/WEP also reviewed the surveillance reports issued from the beginning of construction through December 1979. (The dome was placed in May 1977). These reports disclosed no comments of unacceptable welding due to porosity.

The refueling pool liner plates were welded by the Boilermaker craft. DOE/WEP determined through a document review that visual and liquid penetrant examinations were performed on all of the liner plate welds, with acceptable results.

Porosity may have existed in some of the welds made by the Ironworkers. Available evidence suggests that any porosity was within acceptable limits.

One concern states that previously inspected and accepted conduit supports have undercut, and could not pass the criteria used for today's inspection. The concern specifically notes that supports inspected before mid 1984 are affected. This concern is not factual.

DOE/WEP addresses this concern through the results of the general plant examinations of safety-related electrical supports fabricated and installed prior to February 13, 1981. These examinations assess the overall adequacy of the subject welds.

TVA, with DOE/WEP concurrence, has analyzed all deviant welds found during the examinations, and found them suitable for service. DOE/WEP performed a generic problem analysis, and concluded that there are no generic problems associated with the unsampled pre February 1981 electrical supports.

It is possible that a support fabricated and installed prior to February 1981 would not meet the undercut criteria applicable to later work. This, however, is not a problem. The acceptance criteria for undercut on welds made prior to February 1981 is less stringent than that imposed for welds made after February 1981. Thus, when the welds are measured against the applicable criteria, they do meet the current standard.

Six employee concerns relate in general terms to poor weld quality at Watts Bar. Specific deficiencies or components are not cited, and where locations are given, they are broadly stated. Three of the concerns relate to piping welds. From the text of the concerns, it is not possible to determine whether the remaining three concerns relate to piping or to structural welding.

DOE/WEP was unable to obtain sufficient detail to establish specific evaluation plans to directly assess these six concerns. Based on the limited information provided by the Concerned Individuals, Welding Project cannot conclusively establish the factuality of the concerns. The DOE/WEP Specific, Special, and General Plant Examination results will serve to address these concerns.

Where the employee concerns identified a problem which could be isolated to a specific item or group of items, these items were placed in Specific Evaluation Groups. Evaluation plans were developed by DOE/WEP, and 100 percent of the items were inspected for the attributes applicable to the issues raised by the concerns. The examination methods were based on the nature of the concern. In some cases, nondestructive test methods were employed which exceeded the original inspection requirements.

Where the problems identified by the concerns could not be isolated to specific items, but could be isolated to specific attributes or features, statistically based sample inspections were planned and performed in Special Evaluation Groups. As in the Specific Groups, the nature and extent of examination was based on the issues raised by the concerns.

Additionally, DOE/WEP performed statistically valid sample examinations in all of the safety-related piping and structural weld populations except for heating, ventilating, and air conditioning ductwork welding. The ductwork was excluded from these samples because TVA had committed to a corrective action plan to reevaluate all of this welding. These General Plant Examination Groups included visual examination of all of the sample welds. Other nondestructive examination methods were also used where specified for the original installation of the sample items.

The DOE/WEP examination results were reported to TVA. Where deviant conditions were identified within the bounded scope of the examinations, TVA performed engineering analyses of the affected items. In most cases, the analyses showed the items to be suitable for service without correction. DOE/WEP reviewed and concurred with the suitability for service analyses. Where corrections were required, TVA committed to perform the necessary rework. The corrective action plans were reviewed and concurred with by the DOE/WEP. DOE/WEP also identified deviant conditions which were outside of the scope of the planned examinations. These conditions were reported to TVA via Independent Deviation Reports. TVA is responsible for evaluation of these conditions, and for any corrective actions necessary. DOE/WEP concurrence is not required. Thus far, none of these independent deviations has resulted in an unsuitable for servic condition.

Welding Project concluded that the nature and extent of the DOE/WEP plant reinspections was such that these six employee concerns were adequately addressed, and that no further action is indicated.

One concern states that the cap welds are questionable on temporary test piping in the Unit 2 Turbine Building. The concern is factual, in that the welds in question would not have met the acceptance criteria for permanent plant equipment welds. This, however, is not a problem.

The temporary piping in question was installed to support chemical cleaning of permanent piping systems. In most cases, temporary construction aids need only safely perform their intended purpose with no resultant damage to permanent plant equipment. The quality acceptance criteria for permanent systems or structures are not applied to the temporary installations.

Watts Bar Engineering personnel examined the welds addressed by the concern, and agreed that the observation made by the Concerned Individual was correct. These welds were not required to be examined for weld quality. They did, however, undergo a hydrostatic test prior to use in the cleaning operation, in accordance with the Watts Bar design specification and the site implementing procedure.

The USNRC identified one concern from a review of the ERT files. The concern states "No reinspection of hangers initiated after clarification of inspection criteria".

Welding Project discovered that the material issues of concern are not welding related. The issue of concern relate to edge distance violations, where supports may have been installed at less than the minimum distance from embedded strip inserts; and to constant support spring hangers being installed using the inspection criteria for variable support spring hangers. It was also learned that the Quality Assurance Category Evaluation Group (QACEG) of the Employee Concerns Special Program completed an investigation of the concern. The concern is factual. The problem, however, has been addressed by the TVA Quality Assurance Program.

One employee concern stated that the PDOs (Pipe Rupture Protective Devices) in the Unit 1 Reactor Building have poor quality welds. The concern is not factual. These welds were reworked and reinspected pursuant to three TVA nonconforming condition reports. The rework was completed in mid 1983.

DOE/WEP identified all of the safety-related PDOs in the Reactor Building and the North and South Valve Rooms by a review of the design drawings. Based on a review of the nonconforming condition reports, DOE/WEP was able to verify that all of the PDOs installed prior to January 1981 were reinspected and reworked as required.

To further address this issue, DOE/WEP used the inspection results from three different examination groups related to civil welds. Of 469 welds examined, 430 were acceptable. The remaining 39 welds displayed deviant conditions which required engineering analysis to determine their acceptability. TVA determined through analysis that all of the welds are suitable for service.

DOE/WEP reviewed and concurred with the TVA analysis. DOE/WEP also performed a generic problem analysis, and concluded that no generic problem exists in the unsampled items in the populations considered.

Complete details of the evaluation of these issues are discussed in Weld Project Evaluation Report WP-46-WBN.

General Welding Concerns Related to Unit 2

Twenty-seven employee concerns raise issues dealing with the quality of safety-related and non safety related welds at Watts Bar Nuclear Plant Unit 2.

Many of the welding related employee concerns applicable to Watts Bar Unit 1 have been addressed through reviews of the TVA welding specifications, site implementing procedures, and process control documentation; and through interviews with cognizant TVA personnel. In that these evaluations were largely programmatic in nature, the results were often applicable to Unit 2 and Common areas as well as to Unit 1.

Twenty-two of the concerns addressed in this section require hardware reinspections in Watts Bar Unit 2. The reinspections have been deferred to the Welding Project Phase II plant examination. These concerns have been placed on Corrective Action Tracking Documents pending completion of the reinspections and evaluation of the results.

Two employee concerns relate to the quality of welding on cable tray supports. One of the concerns states that the inspections on the cable tray support welds could not pass the criteria used for today's inspections. The other concern states that cable tray supports exhibit undercut. Examples are given with approximate locations in Unit 2.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes these concerns in the Unit 2 weld evaluation program.

One employee concern states that many cable trays have location brackets which are not welded to the cable tray supports. The CI estimates that 20 to 25 percent of the brackets in the Unit 2 Annulus have not been welded.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

The USNRC identified the following concern from review of the ERT files: "Additional welds on hangers." From review of the files, the concern appears to affect welds on HVAC hangers addressed by a NCR. These welds did not appear on the original drawings.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One concern states that the welds on approximately 240 to 250 conduit supports have not been inspected by Weld Engineering. The Electrical Engineering Unit has performed the configuration inspections as required.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that in Reactor Building 2, there are twelve-inch stainless steel pipe welds which are undersized and concave.

This issue will be resolved through CATD 50400-WBN-08. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that excessive undercut, lack of filler metal, and lack of penetration exist on pipe and structural welds throughout the Unit 2 Turbine Building.

This issue will be resolved through CATD 50400-WBN-07 and 50400-WBN-09. The corrective action plans include this concern in the Unit 2 weld evaluation program.

Two employee concerns state that structural welds in the Unit 2 Turbine Building and North Valve Room were inspected and accepted; and that the welds were subsequently reworked to correct such flaws as undersized welds, undercut, oversized welds, and slag left on welds.

These issues will be resolved through CATD 50400-WBN-05 and 50400-WBN-09. The corrective action plans include these concerns in the Unit 2 weld evaluation program.

One employee concern states that stainless steel welds seem to have excess metal removed at butt weld joints. The CI states that this is a generic condition noticed in both units.

DOE/WEP requested additional details from ERT. The response provided specific examples in Units 1 and 2. This issue has been evaluated and resolved for Unit 1. Details of the evaluation may be found above in General Welding Concerns Related to Unit 1, Units 1 and 2, and Common Areas.

For Unit 2, the issue will be resolved through CATD 50400-WBN-08. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

This concern raised a second issue, that the welds exhibit excessive shrinkage at circumferential joints. The issue is addressed above for both units in General Welding Concerns Related to Unit 1, Units 1 and 2, and Common Areas.

One employee concern states that inspectors will often reject a weld for being undersized or oversized without performing adequate inspections. The CI noted that the inspectors "eyeball" the weld and make a "judgement" call. The text of the concern shows that these inspectors were not known to the CI.

The concern may be factual. The concern specifically states that the inspectors rejected the welds. There is no mention of questionable measurement practices when the weld is to be accepted. Thus, a deficiency remaining on the hardware is unlikely. There are several circumstances where undersize is readily apparent in a weld without actually taking a measurement. Any significantly undersized fillet weld is usually identified before a measurement is taken. Also, underfilled butt joints are visually detectable by reference between the surface of the weld and the two abutting surfaces.

In that the inspectors involved are not known, nor is a timeframe, building, area, or system identified, it is not possible to conclusively establish the factuality of this concern.

CATD 50406-WBN-01 recommended that TVA set in place a systematic approach to monitoring inspector effectiveness, and to provide early warning in the event of a problem with the performance of an inspector. At Watts Bar, the desired program enhancement has been implemented through a formal Quality Control Reinspection Program.

One employee concern states that welds are being reworked too many times, which may impair the quality of the welds. Specific details were not provided.

There is no code or industry standard applicable to Watts Bar which limits the number of times a weld may be reworked. Additionally, the TVA welding program does not impose any such restriction.

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code and the American Welding Society Structural Welding Code require only that the specified examination of the original weld be repeated for the repair welds. These code requirements are defined in the applicable TVA process specifications. Thus, so long as a reworked weld meets the specified examination acceptance criteria, it is acceptable.

One employee concern states that Unit 2 has a hanger which does not meet the drawing requirements relative to weld length. The CI states that TVA Supervision instructed an individual to turn the paperwork over to them (supervision), because they did not agree with the individual's decision to reject the hanger. The concern provides a specific location by column line and elevation.

This issue will be resolved through CATD 50400-WBN-03. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One concern states that when Craft call for inspections, they only request inspection of newly reworked areas; and that inspectors often overlook old work that is discrepant. The CI provides two examples, with approximate plant locations.

Where an item has previously been inspected and accepted, and subsequently reworked, only the specific features which are affected by the rework are required to be reinspected. Thus, the concern that the Craft only requests inspection of the newly reworked features does not present a problem.

The CI does, however, identify two structures which he/she believes to be deficient. Therefore, this issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that a craft (known to the CI, but not identified in the concern) is either not qualified or just doing shoddy work. The concern provides two examples of specific deficiencies. One hanger is specifically identified. The second example is identified by approximate location.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that hangers in the Unit 2 Reactor accumulator are not welded completely around the outside of the hanger. The concern states that this is due to other conduits and pipes in the way of the welders.

This issue will be resolved through CATD 50400-WBN-04. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One concern states that welds in the Unit 2 Reactor Building are not put in according to the procedure. The welds are not stenciled. The text of the concern provides an approximate location and description of the support welds in question.

The Nuclear Safety Review Staff (NSRS) investigated and determined that the concern is factual. The problem, however, had been previously identified and addressed through a TVA nonconforming condition report.

One employee concern states that the Units 1 and 2 reactor vessels inside the cavity wall and the T-Bar shims exhibit cracks.

Additional details provided by ERT showed that the items in question are the cold and hot leg motion restraints (T-Bars) on the Reactor Coolant System Loops 3 and 4 in both units. The CI did not intend the concern to apply to the vessels.

For Unit 1, the concern was evaluated and found to be partially factual. It did not, however, represent a problem. Complete details of the evaluation of this issue for Unit 1 may be found above in Nuclear Steam Supply System Support Welds.

For Unit 2 this issue will be resolved through CATD 50400-WBN-02. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One concern states that Unit 2 Turbine Building welds were painted over slag; and that the slag could be broken off by hand. An approximate location was given.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that a hanger may have been improperly inspected because of inaccessible welds. DOE/WEP requested additional information from ERT. The response identified a specific hanger.

This issue will be resolved through CATD 50400-WBN-05. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One concern states that there are welds with bad looking caps and appearance in the Unit 2 accumulator area. The text of the concern provides two examples. These examples characterize the welds as not capped completely; and poor welds, which look structurally inadequate. Approximate locations for the two supports in question are provided.

This issue will be resolved through CATD 50400-WBN-04. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One concern states in part that a hanger is made of 4-inch I beam instead of tube steel. This is one of the supports provided as examples in the preceding concern. Therefore, it is probable that the approximate locations provided will be adequate to identify the support in question, and to determine whether a 4-inch wide flange shape is an authorized substitution for structural tube steel on that support.

This issue will be resolved through CATD 50400-WBN-04. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that nondestructive examination (magnetic particle or liquid penetrant) has not been performed on fit up or final weld inspections of protective devices in Unit 2 since July 1984. This concern is factual. It does not, however, represent a problem.

The Watts Bar construction specificacion for fabrication and installation of the protective devices does not require liquid penetrant or magnetic particle examination of the subject welds. Also, these examination processes were not required by the design drawings.

One concern states that some four-inch diameter pipe was erroneously cut out; and that when the error was discovered, the pipe spools were cleaned up and rewelded without documentation or authorization. The text of the concern identifies the lines and provides specific locations.

This issue will be resolved through CATD 50400-WBN-08. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

Two concerns relate to improper profiles on pipe welds. One of the concerns identifies specific discrepancies and a specific location. The other concern gives a pipe size, and approximate elevation, and no location.

This issue will be resolved through CATD 50400-WBN-08 and 50400-WBN-10. The corrective actions plans include these concerns in the Unit 2 weld evaluation program.

One employee concern states that welds on the 24-inch Main Steam line in the Unit 2 Turbine Building are not completed.

This issue will be resolved through CATD 50400-WBN-07. The corrective action plan includes this concern in the Unit 2 weld evaluation program.

One employee concern states that a specific hanger has "unaccepted" welds. The text of the concern provided a specific location and elevation for the hanger.

Investigation by NSRS showed that this concern is factual. It does not, however, represent a problem.

The NSRS review showed that the subject hanger was in process, with no welds accepted by Quality Control. The craft had identified welds on the hanger as being deficient due to excessive porosity. Additionally, the support was to be removed to facilitate testing of the concrete anchors.

The craft supervisor decided that it was more feasible to build a new support rather than to repair the existing welds. A work release was issued to cut the hanger down. NSRS verified that the support had been cut down, and that the replacement item was in process of being fabricated.

Complete details of the evaluation of these issues are discussed in Weld Project Evaluation Report WP-32-WBN.

3.9 Welding Inspection Program and Procedures

Twenty-five employee concerns raise issues dealing with the welding program and inspection procedures used in safety related applications at Watts Bar Nuclear Plant.

Three employee concerns relate to inadequacies in the welding inspection program at Watts Bar.

Two of the concerns state that prior to 1979, there was no specific inspection criteria for use by inspection personnel. These concerns are not factual.

The first safety-related welding was performed at Watts Bar in 1974. Mechanical welding began in April 1974, and structural welding began in September 1974.

The Quality Control Procedure which governed welding inspection was issued in January 1974. This procedure required that nondestructive examination of welds be performed in accordance with the process specifications which form General Construction Specification G-29, Process Specifications for Welding, Heat Treatment, Nondestructive Examination, and Allied Field Fabricated Operations.

The process specification for visual examination of mechanical welded joints provided the inspection criteria for welding governed by the American National Standards Institute and the American Society of Mechanical Engineers Boiler and Pressure Vessel Codes. This specification, with one exception, adequately provided all of the required inspection and acceptance criteria.

Prior to March 1979, this specification did not consider that the required weld size for socket welding flanges was greater than that for fittings. The specification was corrected in March 1979 to meet the requirements of ANSI B31.1 and ASME Section III.

Beginning in 1980, a series of nonconforming condition reports was issued to address undersize socket welds. The reinspections, rework, and engineering analyses resulting from these NCRs included any socket welds on flanges which may have been undersized due to the omission in the process specification.

From the beginning of construction, the process specification for structural welding provided all of the necessary inspection requirements and acceptance criteria for welded joints made in accordance with the Structural Welding Code, AWS D1.1

In 1983, a series of separate implementing procedures was issued to address each of the nondestructive examination processes. This new series of Quality Control Procedures included all of the inspection requirements and acceptance criteria within the procedures rather than by reference to the process specifications. They adequately define all of the inspection criteria required by the process specifications.

The third concern in this group states that the visual examination procedure which covers ASME Section III is very nonspecific. This concern is not factual.

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code does not specify any visual inspection requirements, rather, the code only addresses radiographic, ultrasonic, magnetic particle, and liquid penetrant examinations.

The ASME Code does state that inprocess and final examinations and tests shall be established to assure conformance with documented instructions, procedures, and drawings; and that process control and inspection checklists be prepared to control and document these quality assurance activities.

The Watts Bar Quality Control Instructions adequately provide the process control and inspection checklists required by the ASME Code.

One of the concerns states that personnel from Welding Engineering performed (welding) inspections. This concern is factual. It does not however, represent a problem.

At the beginning of construction, the weld inspection personnel were assigned to the Mechanical Engineering Unit, which included Welding Engineering. A separate Welding Engineering Unit was later formed, and included the welding inspectors.

These inspection personnel, while assigned to the Welding Engineering Unit, were individuals whose principal responsibility was welding inspection. They were properly trained and certified in accordance with the TVA Quality Assurance Program.

Two employee concerns relate to welding inspections not meeting code requirements.

One of the concerns states that "QC inspections from 1976 to 1982 did not meet code requirements. Only what the craft considered to be quality."

The text of this concern does not provide sufficient information to identify the material issue of concern. A review of the computerized Employee Concern Information listing showed that the CI lodged a series of eight welding and quality assurance related concerns. It appears that this, the first concern in the series of eight, was intended as a general statement during the interview, rather than a specific concern.

Of the seven specific concerns raised by this individual, two have been addressed by Quality Assurance Category 80000. The remaining concerns are discussed elsewhere in this report. Therefore, this nonspecific concern is not discussed further in this evaluation.

One of the concerns states that a stop work order was not issued in response to NDE/inspection deficiencies identified in late 1981 or early 1982; visual inspections were not being performed by designated personnel; and the NDE procedur were not documented as being demonstrated to the Authorized Nuclear Inspector as required by the TVA Specification and ASME Code. The concern is partially factual.

The deficiency reporting documents issued at Watts Bar from 1974 through 1985 did not reveal any discrepancies in the nondestructive examination or weld inspection program which warranted a stop work order. There have been isolated occurrences of implementation error which were corrected through the Quality Assurance Program.

The deficiency reporting history for Watts Bar was reviewed to determine whether any personnel other than the properly qualified and certified inspectors performed any of the required weld examinations. This review revealed two instances where personnel performed inspections for which they were not properly certified. These two instances were identified and corrected in accordance with the TVA Quality Assurance Program.

The ASME Boiler and Pressure Vessel Code requires nondestructive examination procedures to have been proven by actual demonstration to the satisfaction of the Authorized Nuclear Inspector (ANI) to be capable of meeting their code intended purpose. In 1981, a Quality

Assurance Audit identified that the NDE Demonstration Record for radiographic examination could not be located. Corrective action was taken by demonstrating the procedure to the ANI and the finding was closed.

In conjunction with recent NDE procedure revisions, it was discovered that some of the early records for the required demonstrations were not on file in the records vault. TVA initiated a Condition Adverse to Quality Report (CAQR), and the early revisions to the NDE procedures for which demonstration records were not available were demonstrated to the ANI.

While the ASME Code requirement for demonstration of the procedures may not have always been properly documented, the acceptability of the examination processes were not in question. Thus, no adverse hardware effect resulted from this deficiency.

Five employee concerns relate to required inspections either not being performed or not being performed in a timely manner.

One concern states that QC inspections of some supports in the Auxiliary and Reactor Buildings may not have been performed. This concern is factual, to the extent that prior to March 1983 certain supports had not been inspected. The problem was resolved through the TVA Quality Assurance Program.

Prior to 1983, the Quality Control Procedure did not require weld inspections for certain supports used in non ASME applications for vent, drain, and pressure tap piping. A nonconforming condition report identified the procedural inadequacy. The NCR was dispositioned to identify and reinspect all of the affected supports. The procedure was revised to require the appropriate weld inspections.

One of the concerns states that "Many welds were uninspected until five years ago." The concern is factual. However, the problem was identified and corrected through the TVA Quality Assurance Program.

The material issue of concern was that hangers for the North Valve Rooms were welded in the fabrication shop and sent directly to the paint shop with no weld inspection performed prior to painting. Five nonconforming condition reports related to this issue were initiated in 1980 and 1981. In each case, an item was shipped from the fabrication shop without a release by the inspector. The items were dispositioned to be inspected in place. Preventive action was taken to instruct the Crafts in the procedural requirement that inspection and a shop release be performed prior to shipment of the fabricated items from the shop.

DOE/WEP evaluated this concern as an issue related to inspection of welds through carbo-zinc primer. The issue of inspection of primed welds was bounded to those welds fabricated prior to November 2, 1981, primed with carbo-zinc, and reinspected from December 1, 1981 through January 23, 1984 without removing the primer. DOE/WEP analysis of the inspection results showed no significant differences in the deviation rates for welds inspected prior to, during, and following the bounded time period.

One concern states that rework of AWS hanger welds is often not inspected for months after the welds have been reworked. The issue of not immediately inspecting completed work has from time to time been factual. It is not, however, a problem.

Priority is given to mandatory QA hold points beyond which work may not progress until the inspection is performed. Completed items, including rework, normally do not constitute such hold points. The Craftsmen may therefore move to other work items with the final inspections being performed later.

One concern states that during 1981 the craft personnel rather than the inspectors were responsible for material heat number sign-off on the Welding Operation Sheet. This concern is not factual.

During the time period in question, the heading section of the Weld Operation Sheet had a blank entitled Heat/Serial/Other Unique No. The identity of the material being joined was entered by the Craft. The actual verification, however, was a Quality Control responsibility. Material verification was a mandatory hold point for Mechanical Engineering which at that time was the organization to which the inspectors were assigned.

One of the concerns states that temporary minor attachments are not documented by the responsible department; and that the applicable welding code requires controls, documentation, and approval by the responsible department. This concern is factual.

The NSRS performed an evaluation of this employee concern in November 1985. NSRS noted that 16 thermocouple lugs were tack welded on a segment of pipe. Due to an incorrect determination that post weld heat treatment was not required, the Weld Operation Sheet for these temporary attachments was voided in 1983. The Work Release issued to remove the temporary attachments had also been voided. A nonconforming condition report was issued to document and correct the NSRS findings. The temporary lugs were removed and the removal area was examined.

DOE/WEP evaluated this issue for Unit 1. A sample of welds which had been post weld heat treated was taken. Documentation could not be found for installation or removal of the thermocouple lugs. Visual examination by DOE/WEP confirmed that all of the lugs were removed.

A nonconforming condition report was issued to document the condition and provide corrective and preventive actions for Unit 1. These actions were adequate to resolve the problem.

A CAQR was initiated to address this issue for Unit 2. The CAQR does not require root cause analyses or recurrence control. This is not a problem, in that the preventive actions required by the Unit 2 NCR apply equally to both units.

CATD 50400-WBN-01 has been initiated to facilitate the Employee Concerns Task Group followup and closure of this issue. The corrective action plan refers to the NCR and the CAQR which require examination and documentation of all of the thermocouple removal areas for which documentation cannot be located or reconstructed.

Four employee concerns relate to welding in the presence of moisture.

The USNRC identified a concern from review of the ERT files. The concern states that while welding caps over drain lines, water was coming through the line and falling on the welder.

A review was performed to identify any concerns related to welding caps on drain lines. This review revealed one employee concern related to using E6010 electrodes on drain lines in the station sump. The Welding Project evaluation of the concern found that the caps were welded to the ends of the drain lines in order to dry the sump. Complete details of this issue are presented in the discussion of unauthorized use of E6010 electrodes in the Control of Welding Filler Material section of this report.

One concern states that welds done on the Unit 1 reactor vessel supports were made under or in the presence of water. ERT determined that the incident which led to the concern was that welding had been done on the plates of the Unit 2 Reactor Building floor during and after a rain storm. TVA responded to ERT and stated that the concern was factual.

It is highly unlikely that welding continued in an open area during a rainstorm due to the possibility of electric shock to the welders. Thus, the Welding Project evaluation is based on the incident occurring immediately after a rain storm.

The presence of moisture was a constant consideration during the installation of the bottom of the containment liner. Standing water from rain and from condensation was typical, and during this early phase of construction, unavoidable. At the onset of rain, the site inspection personnel immediately moved through the area to ensure that all welding was stopped.

ERT established that the contractor (Chicago Bridge and Iron) utilized air hoses and a flame torch to dry and preheat the affected areas. This was substantiated by Welding Project. It was regular practice to dry and preheat the weld area in front of the welding operation. This acceptable practice would have been necessary whether or not rainwater was present, due to heavy concentrations of condensation.

ERT noted that the nondestructive examinations performed on the work would not have detected sub surface porosity, underbead cracking, or slag inclusions. The ERT investigation report states that all of these defects could be present as a result of welding in the presence of water.

Welding Project concurs with the TVA response to the ERT investigation which shows that these defects were unlikely to occur or if they did occur would have been detected by the visual and/or the nondestructive examinations. The containment liner plate welds were examined by the visual, vacuum box, and magnetic particle methods. Additionally, the pressure boundary welds were covered with leak test channels and pressure tested.

One of the concerns states that welds may have been made in an improper manner. DOE/WEP learned that the material issue of concern was actually welding with water on the electrode. In the absence of further details, Welding Project cannot conclusively prove or disprove this concern. One such incident occurred in 1980 and was addressed by a TVA nonconforming condition report.

In 1980 ,while weld metal was being added to a seal weld on a one-half inch threaded pipe connection, the weld seal began to leak. The addition of weld metal was continued until the leak was stopped. A nonconforming condition report was issued to document and correct the deficiency. The pipe was drained, the weld was removed by grinding and the necessary repair was performed.

One employee concern stated that an "unapproved technique (was) used in welding." DOE/WEP contacted ERT and learned that the material issue of concern was that the Steamfitters stuffed bread into a stainless steel pipe to stop water. In the absence of further details it was not possible to establish or to disprove the factuality of this concern.

Outside of the nuclear construction industry, bread is occasionally used as a dam to stop seepage in order to provide a dry welding area. The practice is effective to prevent small amounts of fluid from flowing into the weld area. Thus, if the incident did occur, it is probable that moisture was not present in the weld area.

The issue then becomes one of maintaining the required system cleanliness. Whether or not bread contains elements deleterious to stainless steel was also considered.

Bread used in this application would quickly break down into small particles of fiber in the presence of liquids. Thus, a blockage of the pipe is not probable. The levels of sulphur, chlorides, and halides in common bread would be negligible when the bread is considered as a possible stainless steel contaminent.

The Quality Control Test Procedure for cleaning and flushing of fluid handling systems provides adequate instructions for ensuring that piping systems meet the required cleanliness levels after construction. Placement of screens and filters is required to remove particulate matter during flushing.

Two employee concerns relate to the Welding Inspectors being inconsistent in their application of the weld acceptance criteria.

One of the concerns states that the welding inspectors were rejecting welds for arc strikes and/or weld spatter outside of the heat affected zone. This concern is factual. It does not, however, present a problem.

The Quality Control Procedure bounds the actual weld inspection area to one inch on either side of the weld for ASME butt joints and one-half inch on either side of the weld for all other joints.

The procedure also states that items which may require further evaluation include indications revealed by inadvertent nondestructive examinations. Arc strikes and weld spatter are listed as weld defects. Additionally, this procedure requires removal of all arc strikes from ASME and ANSI components. The extent of examination after removal is dependent on the code class of the component.

While the base metal area required to be examined with the weld is bounded by the procedure, the definition of arc strikes and spatter as defects, and the requirement for removal of all arc strikes is clear. The Quality Control Procedure does not provide specific instructions for disposition of arc strikes or weld spatter found outside of the defined area of inspection.

It is possible that some inspectors treated arc strikes and spatter found outside the weld area as indications found during inadvertent inspections and withheld acceptance of the welds being examined. If the Welding Inspectors did reject welds for arc strikes and weld spatter outside of the defined weld inspection area, no adverse hardware effect would have accrued.

One of the concerns stated that in early 1985, the inspectors were inconsistent in their application of the inspection criteria. The material issue of concern is the maximum allowable oversize for a weld. The CI cited three different criteria applied within a short timeframe. The concern is partially factual, in that the maximum allowable oversize for a fillet weld depends on a number of variables.

During the stated time period the inspection criteria emplaced different weld oversize limits based on the date the welding was completed. These criteria were in accordance with the applicable Process Specification. Additionally, some of the design drawings specified unique weld size criteria which differed from that defined by the procedure.

One employee concern states that a significant number of the inspectors are more concerned with hanger welds than with pipe welds. This concern may be factual. It does not, however, present a problem.

DOE/WEP requested additional details from ERT. The ERT response shows that the material issue of concern is that the inspectors were "nit-picking" the hanger welds. The CI had no specific concern relating to pipe welds. It was also learned that the CI began working at Watt Bar in 1981.

In that the CI was employed in 1981, and lodged the concern in 1985, it can be seen that most of the time worked was during a massive reinspection effort, largely directed toward structural fillet welds. Beginning in 1980, a number of nonconforming condition reports were issued to document known and suspected deficiencies in fillet and socket welds. These NCRs resulted in several reinspection programs which included thousands of hanger welds.

The perception that an inspector is more interested in hanger welds than in pipe welds is not unexpected. Had these reinspections not occurred it would still be expected that more inspector effort would be directed toward hanger welds than pipe welds. This is not related to a relative importance of the welds. Rather it is a natural outgrowth of the welding inspector's experience, which dictates that the hanger is more likely to display a discrepant weld than is the pipe.

DOE/WEP addressed this concern through a combination of the results of the general plant examination samples of statistically selected piping welds. All recreatable visual and nondestructive examination criteria imposed by the engineering drawings were used in the examinations. All of the components bounded by the DOE/WEP group were determined by TVA to be suitable for service.

One employee concern states that weld inspection of nonsafety related items is performed by individuals who have little or no training in weld inspection such as engineers. The material issue of concern is that if weld inspection is required as part of the construction process, TVA should assure that the individual is competent to perform the inspection. While this concern is factual, it does not represent a problem, rather, application of a good construction practice is indicated.

The training, qualification and certification of those personnel engaged in inspection of welds within the scope of the Quality Assurance Program is examined in detail in Welding Project Evaluation Report WP-06-WBN, Inspector Training and Qualification at Watts Bar Nuclear Plant. The results of this evaluation are discussed in the Inspection section of this report.

The text of the concern bounds the area in question to those welds which are not required to be included under the TVA Quality Assurance Program.

Certain systems and components by design are not required to be inspected by certified welding inspectors. It is, however, an exercise of prudent judgement for the responsible construction engineer to take some steps to ensure that these items are fabricated and installed as intended by the designer. These steps often include some degree of visual examination. It is common practice throughout the construction industry for the field engineering personnel to check for the presence, location, and configuration, of nonsafety related welds. It is important to note that the informal verifications performed by engineers are not "inspections" in the sense of the independence required by ANSI N45.2.5 or the formal qualification and certification required by USNRC Regulatory Guide 1.58 and ANSI N45.2.6.

Two employee concerns relate to weld repairs being made improperly.

One of the concerns states that TVA does not repair welds in accordance with 10CFR50 Appendix B and the ASME Code. The material issue of concern is that weld repairs made prior to the original weld documentation being vaulted are not documented under the program established by Modifications and Additions Instruction MAI-6, Control of Weld Documentation. This concern is not factual.

MAI-6 allows inprocess rework at any time during the welding process without additional documentation, provided that the final surface examination had not been performed. This is an acceptable practice.

One of the concerns states that management directed that a weld be repaired in violation of procedure, then denied directing the craft to make this violation. The concern notes that the weld may have been corrected, but that the subject management individual had ordered many violations to procedures. Whether or not this concern is factual is indeterminate.

The general issue of management or supervision directing subordinates to perform work improperly is addressed in Management and Personnel Subcategory 70600, and is not discussed further in this evaluation.

The type of plant feature (pipe, hanger, etc.) affected is not identified by the concern. DOE/WEP requested that ERT provide additional details. There was no response to the DOE/WEP request. Thus, it cannot be established through specific inspections or document reviews whether the concern is factual. The DOE/WEP General Plant Examination results will serve to resolve this issue.

DOE/WEP performed statistically valid sample examinations in all of the safety related piping and structural weld populations except for heating, ventilating, and air conditioning ductwork welding.

The DOE/WEP examination results were reported to TVA. Where deviant conditions were identified, TVA performed engineering analysis of the affected items. In most cases, the analysis showed the items to be suitable for service without correction. DOE/WEP reviewed and concurred with the suitability for service analysis. Where corrections were required TVA committed to perform the necessary rework. The corrective action plans were reviewed and concurred with by DOE/WEP.

Welding Project concluded that the nature and extent of the DOE/WEP plant reinspections was such that this employee concern is adequately addressed, and that no further action is indicated.

Two concerns relate to welder identification. One of the concerns states that welders are not required to stamp their welder identification numbers on the welds. The second concern states that some welds are not stenciled.

The ASME Boiler and Pressure Vessel Code and the ANSI Power Piping Code require that the welder apply his identification mark on or adjacent to all permanent welded joints made by him; or, as an alternative, the manufacturer or the installer shall keep a record of the permanent welded joints in a component and the welders used in making each of the joints.

The AWS Structural Welding Code required that the welder be qualified for the work performed, but does not require that the welder's identification be applied to the workpiece or recorded.

At the beginning of construction the requirement to either mark the workpiece or record the welder's identification was not defined in the procedures. The procedure did require maintenance of weld history documentation but did not provide the specific details for implementation of the requirement.

A review was performed to determine whether or not the process documents in use at the beginning of construction provided for recording of the welder identification for each weld. Welding Project reviewed the Welding Operation Sheets and Weld History Records for three original welds and five weld repairs made during the first month of safety related welding at Watts Bar. The welder identification was recorded in the appropriate space on each of the Weld History Records.

Thus, while a weakness existed in the control procedure, there is objective evidence to show that TVA at Watts Bar was in compliance with the ASME and ANSI code requirements for welder identification at the beginning of construction.

In 1976, the Quality Control Procedure was revised to require that "The welding inspector shall not accept welds which have not been stenciled with the welder's ID No. on the weld. This mark shall be present on all applicable components prior to release of materials from shops and prior to embedment of materials in concrete."

The procedure was again revised in 1978 to allow welder identification either by marking the workplace or by identification of the welder on documents traceable to the workpiece.

In 1982, the specific requirement that the inspector not accept welds without the welder's identification either being marked on the workpiece or documented was removed from the procedure. The Weld Operation Sheets, however, were attached to the procedure. The Weld Operation Sheets required documentation of the welder's identification for each weld. The Construction Superintendent was responsible to ensure that the process control documents were properly completed and attached to or nearby the work item. The welding inspector was responsible to ensure that the Operation Sheets were completed prior to returning them to the Welding Engineering Unit. Prior to being stored, the Weld Operation Sheets were reviewed by the Welding Engineering Unit and the Quality Control Records Unit. Additionally, the Authorized Nuclear Inspector reviewed all completed Operation Sheets for ASME welds.

In 1983, the Construction Superintendent's responsibility for completion of the Weld Operation Sheet was more clearly defined, in part to specifically require entry of the welder's identification. This requirement is reflected in the current procedure.

Review of the audit reports, surveillance reports and nonconforming condition reports issued at Watts Bar from 1975 through 1985 revealed occasional failures to stencil the welder identification numbers on the workpieces. This review did not produce any reports of failure to document the welder identification for ASME Section III or ANSI B31.1 welds for which documentation is required under the quality assurance program.

One employee concern states that ASME welding problems have not been reported or corrected. This concern is not factual.

The welding related nonconforming condition reports, Quality Assurance audits, Quality Control surveillances, and USNRC inspection reports issued at Watts Bar from 1975 through 1985 were reviewed. This review clearly showed that throughout the history of the plant, ASME welding problems were identified as they occurred, documented and corrected. Where applicable, welding nonconformances were reported to the USNRC pursuant to 10CFR50.55(e).

One of the concerns states that from 1974 to 1976 welds were made that did not conform to the procedure. The example given was that some welds were made with an open root joint configuration, using E7018 electrodes. The CI also stated that the welds were "updated" on paper, but were not reworked to the later procedure.

DOE/WEP contacted the ERT and requested additional details. The response stated that the piping in the 60 inch Condenser Cooling Water System was welded with E7018 electrodes; that the pipe was prepared for open root welding and that no procedure existed for open root welded joints.

Relative to the procedure actually used to weld the joints in question, the factuality of the concern cannot be conclusively determined. That part of the concern which states that no procedure existed for making open root welded joints is not factual.

TVA has qualified Detail Weld Procedures for making open root welded butt joints in large bore piping. Additionally, E7018 electrodes are qualified for use with these procedures under certain conditions.

Typically, the TVA weld procedures allow open root welding without a backing ring when the root pass (first layer of weld metal) is made with the GTAW process; or with the shielded metal arc welding process using E7010 electrodes. The remainder of the weld groove is then filled with E7018 electrodes. When a backing ring is used, the entire joint is typically filled using E7018 electrodes.

Review of the design drawings showed two 60-inch pipes related to the condenser. One of the pipes is above ground, located at the cooling tower. The second pipe is underground as described by the CI.

The pipe in question was part of the Condenser Circulating Water System. When put in place, the pipe was classified as nonsafety related and Welding Operation Sheets are not available for the installation welds. In that the pipe is now underground it is not accessible for inspection. Therefore, the procedure actually used in making the welds cannot be conclusively determined.

Three Detail Weld Procedures (DWP) were authorized for use on the subject pipe welds. These procedures provided the option of making single vee groove welds, either with backing rings or with a gas tungsten arc welded root pass. E7018 electrodes were specified for the filler passes in each of the procedures. The CI may have observed E7018 filler material being deposited over a GTAW layer or over a backing ring, either of which is acceptable.

It should also be noted that the pipe in question has been abandoned in place. Thus, if the welds were not made in accordance with the prescribed Detail Weld Procedure, it would not result in an adverse hardware condition on a permanent plant feature.

One concern raises the issue of incorrectly receiving an Inspection Rejection Notice (IRN) for insufficient weld on an instrumentation hanger. The issue of using the IRN to justify disciplinary action is addressed by Management and Personnel Subcategory Report 70200 and is not discussed further in this evaluation report.

Complete details of the evaluation of these issues are discussed in Weld Project Evaluation Report WP-43-WBN.

3.10 Other CATDs

This section of the report contained two CATDs that are not addressed in the previous sections of this report. One CATD addresses an observation by an evaluator while performing an investigation of an unrelated issue. The second CATD addressed a condition found acceptable by the employee concern evaluation but is addressed on a condition adverse to quality report generated by the Site Quality Assurance Group.

CATD 50400-WBN-12 was generated to address an observation that was identified during the investigation of an employee concern in the south valve room in Unit 1. This observation was not related to the investigation being performed. The evaluator observed welds which appeared to be undersized on a component support.

The CAP for this CATD will provide for a reinspection of the identified welds in accordance with the TVA acceptance criteria and any unacceptable welds will be documented in accordance with the TVA condition adverse to quality program.

CATD 50400-WBN-13 was generated to track the closeout of Condition Adverse to Quality Report WBN 870286. The CATD listed two employee concerns which addressed welder's identification not placed on piping components. The CAQ was generated to address the requirements for welders identification under the Nuclear Quality Assurance Manual (NQAM) Part II, Section 6.1, paragraph 5.4.8 for ANSI B31.1 welds. Random field inspections of ANSI B31.1 weldments revealed inconsistencies in hard markings of the welder's identification on pipe surfaces. The alternative method of recording the welder's identification is to record the identification on weld data sheets, however, the data sheet is not a life of plant record.

The Weld Project Evaluation review of the audit reports, surveillance reports, and nonconformances issued at WBN from 1975 through 1985 revealed occasional failures to stencil the welder identification numbers on the workpiece. Those instances occurred between 1975 and 1981. The review did not produce any reports of failure to document the welder identification of ASME Section III or ANSI B31.1 welds for which documentation is required under the quality assurance program.

The CAP for this CATD is being conducted through the disposition of the CAQ. The disposition of the CAQ accepts the condition as-is because the NQAM requirement applies to critical structures as defined by the Final Safety Analysis Report (FSAR). FSAR table 3.2-5 for non nuclear safety classification states that only TVA piping classes G and H are covered under the ANSI B31.1 code and, therefore, are noncritical structures that do not fall under the requirements of the NQAM. Upon close out of the CAQ, a closure package will be prepared and forwarded to the Employee Concerns for closure of the CATD.

## 4.0 COLLECTIVE SIGNIFICANCE

Through the subcategory overview of the evaluation report findings and the subsequent integration of information, no new significant items were identified.

The Weld Project evaluations and the subcategory overview indicated that the procedures and the practices used at Watts Bar were consistent with good industry practices.

The DOE/WEP evaluated 472 employee concerns that involved TVA-performed safety-related weld issues at WBNP-1. Of these, 451 were not specifically confirmed. Three out of twenty-one confirmed employee concerns had been previously identified and resolved, or included in the TVA quality assurance nonconformance system for resolution. Three employee concerns are part of a TVA corrective action plan for the HVAC systems and one was part of a TVA corrective action plan for documentation on installation and/or removal of temporary attachments. The remaining welds identified by 14 employee concerns are in compliance with the applicable code and required no corrective action. Although the employee concern welding issues were numerous and potentially significant, upon evaluation, they did not identify any specific unsuitable-for-service components in the plant.

Although this welding subcategory report addressed 390 employee concerns and DOE/WEP evaluated 472 employee concerns, all employee concerns for WBN were addressed by the employee concerns program. The employee concerns addressed by the DOE/WEP and not addressed by this subcategory report were addressed by other categories. These issues included welding related issues that dealt with QA/QC practices, intimidation and harassment, engineering practices and design, and management and personnel and are addressed within their reports. The evaluation report investigations and the subcategory overview indicated that the procedures and the practices used at WBN were consistent with good industry practices used throughout the country.

TVA's welding control practices were adequate and reflected common industry practices. Some problems were identified as one would expect with the size of the operation and the timeframe and were addressed by the ongoing QA Program and the Weld Project Evaluation Reports.

## 5.0 CAUSE

The cause of a perceived problem or the cause of a problem which prompted the initiation of a CATD is limited to the cause identified in the Weld Project Evaluation Report.

## 6.0 CORRECTIVE ACTION

Two corrective action documents were issued as a result of this subcategory report because the CATDs are not addressed by the Weld Project Evaluation Reports. One CATD addressed an observation by an evaluator while performing an investigation of an unrelated issue. The second CATD addresses a condition found acceptable by the Weld Project Evaluation Report but is addressed on a condition adverse to quality report generated by the site Quality Assurance group. These CATDs are limited to a specific issue and do not identify any new significant items.

No additional corrective action is specified as a result of this subcategory report. Corrective actions issued for the Weld Project Evaluation Reports that address problems or perceived problems are limited to the CATDs.

Discussions of enhancements to the existing TVA system, other than the enhancements specified by CATD 50426-WBN-01 will be deferred to the Welding Category Report. CATD 50426-WBN-01 was issued to recommend that the implementing procedures be revised to reflect actual practices.

## 7.0 ATTACHMENTS

A. Subcategory Summary Table

B. Summary of Issues

## 8.0 REFERENCES

A. Welding Project Evaluation Reports