

Attachment 1. Potential Evidentiary Request List

1. Metallurgical Samples From Nozzle 3

It is desirable to obtain the remaining section of Nozzle 3 from the elevation of the cut to the bimetallic weld to the CRDM nozzle flange. Note: *The specimen should not be cleaned prior to input from the Root Cause Team.* This specimen may be used for the following examinations and tests:

- a. Examination of external surface of nozzle looking for evidence of flow up through the annulus. Include high quality photographs
- b. Metallurgical examinations including chemistry, microstructure, etc.
- c. Hardness traverse through the wall thickness (similar to Ocone 3)
- d. Tensile properties at three locations through thickness (similar to Ocone 3)
- e. Others as identified

2. Non-destructive Inspections of Top Head Surface at Nozzle 3 Location

It is desirable to perform several non-destructive inspections of the top head surface:

- a. Priority 1: High quality photographs of the corroded areas adjacent to Nozzle 3. The purpose of the photographs is to show:
 - General extent of corrosion
 - Evidence of flow across clad and base metal surface
 - Evidence of possible impingement of steam jet on surfaces
- b. Priority 2: Casting impression of cavity. The purpose of the impression would be to further aid in identifying the boric acid corrosion mechanisms such as
 - Volume loss
 - Location of volume loss relative to leak
 - Undercutting of low-alloy steel at cladding interface (potential)

3. Specimens From Remaining Material at Nozzle 3 Location

It is desirable to remove specimens of the unsupported J-groove weld and adjacent areas of the unsupported clad. The priorities for these examinations are as follows:

- a. Priority 1: The section of the J-groove containing the downhill ($\approx 0^\circ$) crack should be removed. This specimen would be used to:
 - Determine the crack geometry (single crack, branches, etc.)
 - Determine the crack width
 - Assess flow induced erosion on the crack faces
 - Assess the potential for the crack to have started at the J-groove weld surface
 - Assess the potential for weld defects
 - Assess the clad thickness and integrity

- b. Priority 2: The exposed surface at the location of the uphill crack located by UT examination ($\approx 180^\circ$) should be evaluated.

The first step should be to perform a PT examination of the surface to determine if the crack remains at the machined surface of the weld metal and weld buttering, and if there is any wastage of the low-alloy steel that may have occurred as a result of the leakage.

If there is evidence of the crack, or of wastage that extends deeper than the machined surface, a casting impression should be made of the surface to record the crack and wastage.

- c. Priority 3: A section from the J-groove weld and small amounts of adjacent low-alloy steel base metal and cladding at the triple point between the weld, low-alloy steel and unsupported cladding. This specimen will be used to assess the surface of the corroded low-alloy steel and the potential for galvanic corrosion between the Alloy 182 weld/clad and low-alloy steel material.
- d. Priority 4: If the unsupported section of clad and J-groove weld are to be removed as part of the repair, it is desirable to remove this entire piece intact including a small amount of the low-alloy steel base material at the ends of the unsupported section of the J-groove weld. This larger specimen would be used for:
- Further assessment of flow and impingement on the clad surface
 - Thickness and structural integrity of the complete unsupported clad
 - Corrosion of the low-alloy steel material adjacent to the cladding

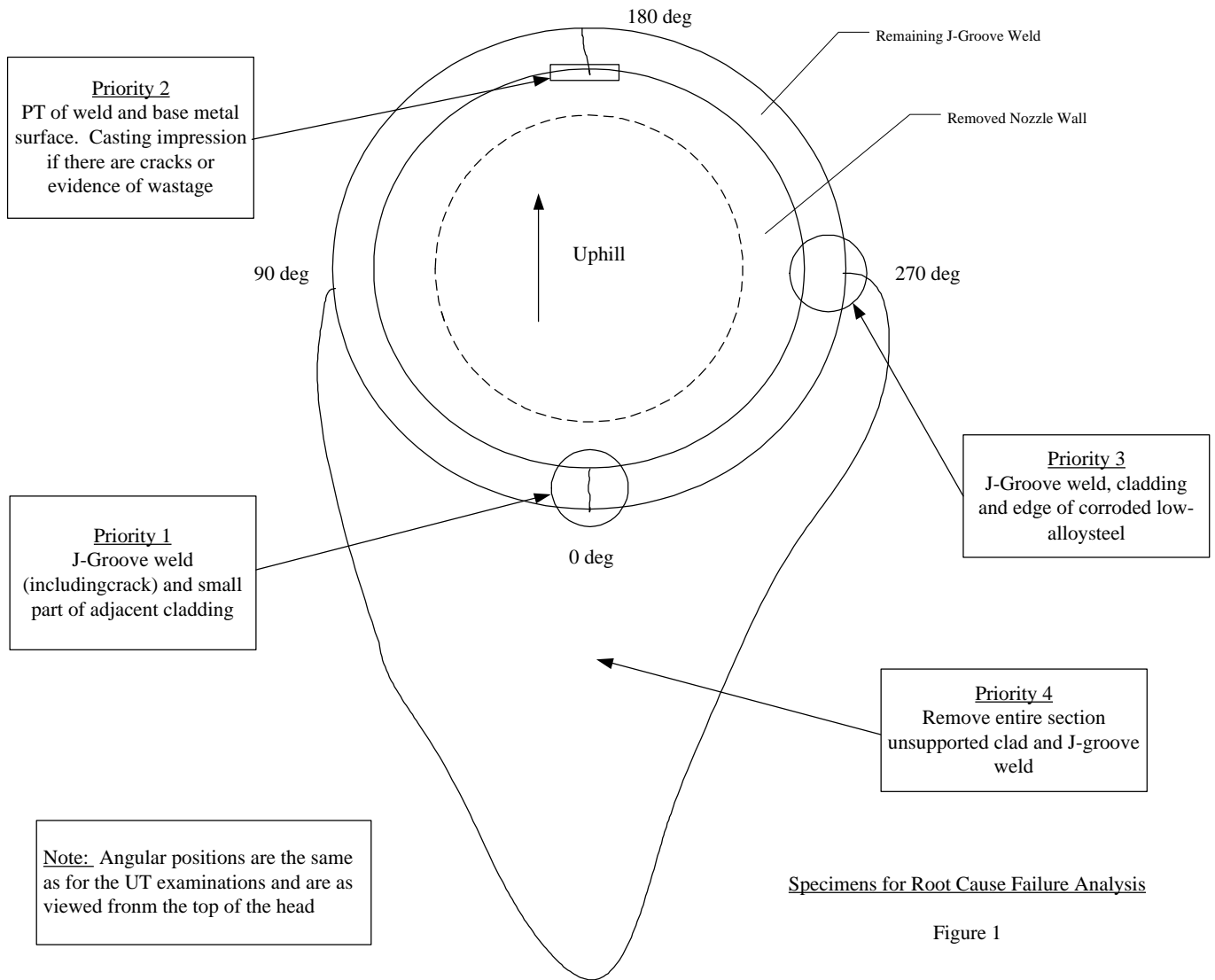
4. Examinations and Potential Specimens From Nozzle 2

The wastage uncovered when the lower part of the nozzle was removed needs to be further characterized since it may be a lead indicator of the type of wastage discovered at Nozzle 3:

- a. A casting impression should be taken of the wastage below the remaining section of the nozzle.
- b. Specimens of boric acid deposits from the cavity behind the remaining nozzle wall should be removed and should be removed and collected in a clean specimen container.
- c. The cavity behind the remaining nozzle should be further probed to establish height above the bottom edge of the remaining nozzle, width, and depth. This information will supplement the already performed boroscope examination.
- d. After access is provided to the top surface of the vessel head the location where the nozzle penetrates the vessel head should be photographed 360° around the nozzle in its current condition. The surface should then be cleaned of any remaining boric acid deposits and the area photographed again. Finally, any crevice between the nozzle and penetration should be characterized by feeler gauge measurements to establish the width and depth of the cavity.

If the above examinations show that the areas of wastage on the top and bottom of the vessel head are not vertically aligned, the Root Cause Evaluation Team should be notified immediately to determine if further examination is required.

If the nozzle is removed as part of the repair, a casting impression should be made of the inside surface of the bore in the vessel head that contains the wastage.



Specimens for Root Cause Failure Analysis

Figure 1

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