1 PURPOSE
To evaluate the condition of the storage tank shell without the need to remove from service for internal inspection.

2 LIMITATIONS
The method, MONPAC, is experience-based and is operated under licence to Monsanto, it is able to identify and grade service-induced damage, for example cracking, corrosion damage, over-stress, in order to determine if there is a need for further localised inspection (NDT). It does not give information on defect size but grades the activity (from “insignificant” to “intense”) and gives recommendations for the extent of any follow-up inspection:

<table>
<thead>
<tr>
<th>ZIP Grade</th>
<th>Interpretation</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>very minor source</td>
<td>none</td>
</tr>
<tr>
<td>B</td>
<td>minor source</td>
<td>visual external</td>
</tr>
<tr>
<td>C</td>
<td>source</td>
<td>further evaluation</td>
</tr>
<tr>
<td>D</td>
<td>active source</td>
<td>follow-up local inspection</td>
</tr>
<tr>
<td>E</td>
<td>intense source</td>
<td>immediate action</td>
</tr>
</tbody>
</table>

Location is primarily “zonal” and indicates the active area(s), location by relative time arrival is possible where sources are intense and reach more than one sensor, this gives a more localised search area. The method does not identify manufacturing defects if they have not propagated during subsequent service, severe manufacturing defects including embrittled welds may be identified during the monitoring of tests to high stress, for example during a hydro-test.

3 PROCEDURE

3.1 Preparation

3.1.1 Supply completed tank information form to SSASI in order that suitability may be assessed. Action: client
3.1.2 Carry out a complete operations/safety review to ensure that changes made during the test will not pose any risk or affect operations adversely. Action: client

3.1.3 Insulated tanks: cut holes in insulation 300mm dia. at locations advised by SSASI. Action: client

3.1.4 Smooth surface of tank/Vessel if rough. Action: client

3.2 Test

3.2.1 Test instrumentation requires a suitable environment (provided by the client) in which to operate a computer (20-30deg C, protected from rain/sun). Action: client

The instrumentation is usually located within 20m of the tank/vessel, much greater distances can be used by prior arrangement.

3.2.2 Power to the instrumentation, 220v/110v 16amp, is provided by generator or mains supply. Action: client

3.2.3 A signal proportional to level in the tank/vessel is provided for direct connection to the AE testing system, 4-20ma or 0-10 volts over the level range being used. Action: client

3.2.4 Sensors are mounted on the tank surface at 3-6m spacing covering the entire area to be monitored. Local paint removal 5x5cm is usually required unless the paint is thin and tightly adherent. Access for sensor placement must be agreed in advance and may be one of or a combination of the following methods:

- SCAFFOLD Action: client
- CHERRY PICKER/ROPE ACCES Action: client

During mounting and connecting the sensors are calibrated. Note: Scaffolding (poles, boards etc) ARE NOT to touch the tank/vessel. Action: client/SSASI
3.2.5 Background noise levels are assessed, conditions must be quiet, i.e.:
- No rain, wind below ~25 knots.
- No noise from re-circ. pumps, down close-coupled pipework or from internal processes. Usually at the 150khz monitoring frequency storage tanks are quiet. **Action: SSASI/client**

3.2.6 The level is raised according to a pre-arranged fill level profile, normally from 90% to 105% of the maximum level the tank has seen in the past 12 months. Intermediate level holds of 10 minutes at 90%, 95%, 100% and a final hold of 30 minutes at 105%. **Action: client**

**Notes:**
- Fluid should be introduced via a submerged nozzle/pipe.
- No entrained gas should be present in the filling medium.
- A large diameter nozzle/pipe should be used to avoid excessive turbulence.

3.2.7 Evaluation of the data is carried out; the MONPAC grades are established for each sensor, and location of any intense sources. **Action: SSASI**

3.2.8 Sensors are removed and the next tank (if applicable) set-up for test, or the site cleared. **Action: SSASI**

3.3 **Reporting**

3.3.1 An on-site report is provided prior to the PAL engineer leaving site, the results are discussed with the client. These would not normally differ from the final report except in the standard of presentation. **Action: SSASI**

3.3.2 The final report, approved by a PAL level III, is usually issued within 4 weeks. **Action: SSASI**
4 QUALITY CONTROL
4.1 Procedure: MONPAC issue 6, (Monsanto licensed procedure), PAL additional signal and location analysis.
4.2 ASNT II AE certified engineers.
4.3 ASNT II MONPAC specific and practical certification.
4.4.1 Job specific quality plan, and method statement.
4.4.3 Digital storage of all data.
4.4.2 Field worksheets.
4.4.4 Route to level III consultant, who approves report.
4.4.5 Traceable calibration of test equipment.