We claim:

1. A process for producing acetic acid comprising:

carbonylating at least one member selected from the group consisting of methanol, dimethyl ether, and methyl acetate in the presence of 0.1 to less than 14 wt. % water, a rhodium catalyst, methyl iodide and iodide salts, lithium acetate maintained at greater than or equal to 0.3 wt. %, to form a reaction medium in a reactor;

separating the reaction medium into a liquid recycle stream and a vapor product stream comprising lithium cations; and

separating the vapor product stream in a primary purification train consisting of a first column and second column, wherein the vapor product stream introduced to a first column to obtain a low-boiling overhead stream and side stream comprising acetic acid and lithium cations, and the side stream is introduced to a second column to obtain a bottoms stream comprising acetic acid, water, C_{10}-C_{14} alkyl iodides in an amount of greater than or equal to 10 wppb, and lithium in an amount from 0.01 wppm to 10 wppm, wherein the lithium in the bottoms stream is derived from and/or generated by a lithium compound in the reaction medium.

2. The process of claim 1, wherein the bottoms stream comprises lithium in an amount from 0.05 wppm to 5 wppm.

3. The process of claim 1, wherein the lithium acetate is maintained in an amount from 0.3 to 0.7 wt. %.

4. The process of claim 1, wherein the side stream further comprises water, methyl acetate, and one or more C_1-C_{14} alkyl iodides.

5. The process of claim 4, wherein the concentration of the one or more C_1-C_{14} alkyl iodides and the concentration of methyl acetate is within 0.9% of the water concentration in the side stream.

6. The process of claim 1, further comprising reducing the lithium amount in the bottoms stream to less than 100 wppb.

7. The process of claim 1, further comprising reducing the lithium amount by greater than 90 wt. %.

8. The process of claim 1, wherein the bottoms stream comprises less than 0.2 wt. % water.

9. The process of claim 1, wherein the bottoms stream further comprises hydrogen iodide.

10. The process of claim 1, further comprising separating the low-boiling overhead stream into a light phase and heavy phase.

11. The process of claim 10, further comprising removing one or more PRC from light phase and/or heavy phase in a distillation column outside of the primary purification train.