

The ER diagram shows the main entities and relationships, but some of the real-world rules behind the system can't be expressed in ER notation. For example, compound ingredients can only list direct materials and can't nest beyond one level or create cycles. Lot numbers for both ingredients and products follow strict formats (e.g., `<ingredientId>-<supplierId>-<batchId>`), and those must be unique to keep inventory traceable. Supplier formulations use effective dates, and the database must prevent overlaps for the same supplier-ingredient pair while ensuring start dates come before end dates. On the manufacturing side, production runs must produce multiples of a standard batch size, and batches can only be created if there's enough unexpired ingredient inventory, with the system preferring lots that expire soonest (FEFO). New ingredient batches are also rejected if they expire in fewer than 90 days. Access control rules stop a manufacturer from creating or consuming batches they don't own. Finally, recall and traceability requirements mean every consumption record has to be preserved so that if an ingredient or lot is recalled, the system can track exactly which product batches were affected during a given time window. These kinds of rules are critical for cost accuracy, food safety, and compliance, but they aren't captured in the ER diagram itself and need to be enforced in the application or database layer.