Secondary containment tanks first appeared in the United States in the early 1980's, when several local and state jurisdictions were just beginning to investigate tank leakage and promulgate rules for hazardous wastes and chemical storage. Secondary containment was one of the solutions to the problem of storage tank leaks.

The first secondary containment steel underground storage tanks were designated "Type II" for their double-walled construction. The two walls of steel were physically separated with angles or channels to create an annular interstice several inches thick in order to hold 110 percent containment of the primary tank capacity. But these systems were costly and bulky. The industry soon realized that 100 percent containment was sufficient to contain the entire contents of the primary tank in the unlikely event of a catastrophic failure.

In 1984, Steel Tank Institute (STI) introduced the first national construction standard for secondary containment tanks. It provided a design for a Type I, intimate wrap, steel secondary containment tank, with several alternative construction methods for enabling the interstice to be monitored for releases.

The STI standard was based on German technology, which had already been in place for a number of years. The Germans were so confident that double wall tanks adequately protected the environment that they did not mandate corrosion protection.

The adoption of national standards was timely. In July of 1986, the final rule for hazardous waste storage was issued requiring double wall tanks. In September of 1988, further rules were published that required all underground hazardous stored substances to have secondary containment. However, petroleum UST systems were exempted from the secondary containment requirement. A number of states have since imposed their own requirements for secondary containment systems of underground petroleum storage tanks.

The technology for secondary containment of steel underground storage tanks has significantly advanced during the past 15 years. Under today's standards, several types of secondary containment constructions are permissible. Each of these technologies incorporates some form of corrosion control along with the secondary containment.

Among double wall steel tanks, the most common STI corrosion control systems are:

- the sti-P3 cathodic-protected steel storage tank,
- the ACT-100 composite tank with a 100 mil coating of fiberglass reinforced plastic resin (FRP) to provide complete isolation of the steel surface from the
corrosive soil environment,
- the thick polyurethane coated ACT-100-U tank
- and the Permatank jacketed tank.

In 1987, the jacketed steel tank containment system was introduced. With the jacketed tank, the outer containment is not steel, but instead, a plastic material. The idea of using plastic as the outer layer for a steel tank was conceived many years earlier for the purpose of corrosion control, not containment. Around 1970, tanks were being wrapped with thin, overlapping plastic sheets sealed together by duct tape in the field. By keeping soil and water from the steel surface, corrosion could be successfully impeded. Since FRP materials had become readily accepted in the marketplace as both a corrosion control barrier and as a containment, the FRP tank jacket was a logical choice for some steel tank producers. Instead of bonding the FRP to the steel primary tank to form a coating, the FRP was separated from the steel primary tank, creating an interstitial space to monitor and contain releases.

Vacuum has become a common method to ensure secondary containment integrity. Many manufacturers apply a vacuum within the interstice at the factory before shipping the secondary containment tank to the installation site. By verifying that the interstice maintains the factory vacuum before backfilling the tank, the installer need not conduct a separate air pressure test of the primary tank and the interstice. The vacuum already assures that both the primary and secondary vessels are tight.

The trend towards secondary containment makes perfect sense. It provides containment to prevent releases into the soil or groundwater and all the undesirable elements that go with a release - report writing, cleanup, lawsuits, and business interruptions. It provides an extra insurance policy, just in case the tank was improperly installed or maintained. It offers peace of mind to the tank owner.

The numbers reflect the trend. Today, according to STI, nearly 50 percent of all steel UST's made in the United States is believed to be secondary containment tanks. Even greater strides have been made in some countries outside the United States. For example, Mexican regulations require that all UST's have secondary containment.

As society became more aware of the hazards with non-compliant underground storage tanks, tank owners also became aware of the great costs involved in cleaning up sites underground to meet regulations. The number of American regulated underground storage tanks decreased from more than two million to less than 700,000 tanks between 1988 and 2000. Where did all of our storage capacity go?

In 1988, many tanks were old and seldom used. Most of these tanks were removed and not replaced. Some tank owners simply began using their local service station for motor vehicle fueling needs rather than self-store their fuel. Many owner/operators began to install their tanks aboveground instead of underground. This trend became quite noticeable after 1990, as AST production boomed. Tank buyers found greater peace of mind with AST's - due to the perception of fewer regulations, and the comforting ability
to visually inspect the tank for leaks.

Since many of these tanks were storing flammable and combustible liquids, fire safety codes served as the predominant regulatory documents dictating requirements for aboveground storage tanks.

The most common new use for aboveground tank installation was for motor vehicle fueling at a private fleet fueling facility. In some parts of the country, aboveground tanks were being installed aboveground at service stations for environmental reasons, but with complete disregard for the fire codes, which generally prohibited such installations.

The next decade saw a tremendous level of activity in the fire codes. New language was adopted in the codes to allow aboveground storage tank installations, with many new safety features built-in, to prevent releases from taking place so that catastrophic failures would not occur. This included the use of secondary containment, insulated/protected tank construction, overfill prevention, thermal expansion and anti-siphon devices, and special emergency vents.

One of the more significant changes took place in the mid-1990's with the spill control requirements of the fire codes. The codes adopted secondary containment tanks, up to 12,000 gallons in capacity, as an equivalent to traditional concrete dike installations.

In order to comply with the new requirements of the Codes, third party test laboratories needed to develop new tanks standards. As a result, new construction standards evolved for protected tanks, fire resistant tanks, and vaulted tanks.

The most common construction, the protected tank, represents a major change in tank construction. The protected tank must be insulated to withstand a 2000 degree two hour pool fire environment exposure without leakage and must incorporate secondary containment.

During the past decade, environmental safety awareness, once focused primarily on underground storage tanks, began drifting towards aboveground tanks. As the new century approached, federal and many state agencies either had adopted or were in the process of adopting new regulations for aboveground storage tanks.

The first proposed revision to the federal AST rule in 1992 was to require impermeable secondary containment for at least 72 hours after a release occurred. This created a whole new movement towards secondary contained AST’s. No longer were spills and releases considered unacceptable only from underground tanks. Steel became a popular option for factory built AST's due to its non-permeable nature.

The initial solution was to install the aboveground tank into a steel dike. However, rain could collect in the dike and, in the presence of hydrocarbons, had to be disposed of as a hazardous material. So manufacturers began to provide rain shields over the dike opening. In order to prevent spills during fill operations from diverting over the rain
shield and onto the ground, overfill limiting valves were introduced for pressurized filling operations.

Tank owners quickly realized that a double wall aboveground tank, similar in construction to the underground tank, could fulfill the same function as a diked AST with rain shield. Soon, the double wall aboveground tank became a popular installation option in both horizontal and vertical construction.

Due to the new trend towards secondary containment tanks, third party test laboratory incorporated alternative secondary containment tank construction and rectangular tank construction into their standards by 1994.

STI responded to the needs of the industry to standardize construction by developing the diked AST F911 standard in 1991, the double wall AST F921 standard in 1992, the Fireguard fire-protected standard in 1994, and the Flameshield fire-resistant tank standard in 1999.

Clearly, the trend toward secondary containment tanks was a reality. Manufacturers saw their secondary contained AST construction orders increase from almost nothing in 1990 to 50 percent or more by the turn of the century. In 1998 alone, STI Members produced nearly 5000 secondary containment AST's built to STI specifications.

New trends continue to evolve with the need for storage tanks. Many industries are opting for the installation of stand-by power generators, including those mounted directly atop generator base tanks, either in the form of single wall, double wall, or protected tank construction.

New designs have been introduced for vertical aboveground storage tank supports. As regulatory agencies further investigate releases from vertical tank floors resting on grade, the ability to see the tank bottom becomes more and more attractive.

With significant advances in secondary containment options of steel storage tanks over the past 20 years, tank owners are given many viable options. Whether or not secondary containment is mandated for their specific application, owners would be well advised to consider the investment as an economically, and environmentally, sound tank installation.