Anti-Bomb Damage Construction in
Bergius Oil Plants in Germany.

Blechhammer S

Transformers in blast wall enclosures heating furnaces of water gas plant may be underground. Hydrogenation stalls in double-walled compartments about 15' high, with concrete framework to 40' - one triple set of stalls have solid walls 46' high. Some tanks buried.

Gelsenberg (Nordstern)

Hydrogenation stalls in brick structures 50' high camouflage.

Leuna Merseburg

Nine pairs of tall reaction vessels enclosed by "stalls" open at the top ? ?

Magdeburg - Rothensee

Camouflage - Some of the tanks are squared off, but the circular tops are still visible. Some of the smaller buildings have been disruptively painted. These tanks are covered by netting.

Pölitz

Injector and paste preparing houses - 39 small tanks surrounded by blast walls. More tanks bunded and provided with blast walls. Camouflage - Netting and smoke screens. Oil storage tanks built in an excavation and are evidently to be mounded. The earthwork protection appears to be for the storage of the more volatile and valuable products. From the standpoint of air observation it has the same effect as good camouflage netting. Hydrogenation stalls are surrounded by tall, thick walls, and the storage tanks are protected by blast walls and are bunded.

Bohlen

Camouflage -

Oil refinery area - 12 tanks arranged in 2 groups of 4 and 8. Each group surrounded by a low blast wall. Tank farm (for the reception of tar). with tanks bunded.

Gelsenkirchen

Camouflage - Netting.

Sunken storage cylinders.

Vulnerability of Bergius Hydrogenation Plants

The equipment in the Bergius hydrogenation plants varies somewhat, depending upon the type of raw material they were designed to treat (lignite tars, coke, bituminous coal, pitch, lignite coal or residues) and upon the end products desired (aviation gasoline or other). They cover each a very large area, from about 200 acres to several square miles (Leuna).

The very high pressures and temperatures called for by the process requires that much of the equipment be unusually heavy, of great thickness and small diameters and of high tensile strength. This is particularly true of the hydrogenation columns or stalls.

The Vulnerability of the Principal Parts of a Bergius Plant may be described as follows:

1. The boiler-power house. These installations vary widely in area. The boilers are special high-pressure types. The destruction of the boiler house would effectively shut the plant, even when outside electric power was availab,e as the steam supply is of equal importance. Replacement of a boiler would require about six to nine months.

2. The high-pressure type hydrogen compressors. These vary in number from about 20 up to 100, and are housed in buildings of about 80' wide with lengths varying from 400' to 1000'. They are spaced at about 25' centres, and are about 6' in width, in a building about 50' in height made in general of sturdy steel-concrete, with a basement or lower floor about 12' deep for the piping and supplementary connections. There is no evidence of any attempt to place these compressors below ground or to reinforce the roofs, which are of steel frame with ordinary roofing cover. A typical evidence is the roof vent, for release of hydrogen gas, a number being arranged in a row on the roof over its compressor. The area may be camouflaged, however. Damage to these compressors would not require a direct hit--they are delicately built, although of huge size, and would be put out of commission by a near hit, and would require months to realign, or nearly a year to replace.

3. Gas Generating Equipment. This equipment involves relatively low pressures, but requires special structures easily identified and destructible. They would require six to nine months to replace, and are relatively few in number, (3 to 6), while their destruction would halt production.

4. Distillation units. These parts of the synthetic oil plant correspond to similarly named plant in ordinary oil refineries; they are not under high pressures (except in the case of the special hydrogen pumps) but are important in that they would halt the output of finished products and require about three to six months to replace.

5. Hydrogenation Stalls, columns and pipe. This equipment, possibly the most important in the plant, is relatively invulnerable. The individual stalls are in general completely separated by a blast wall or fire wall, which would prevent any explosion or hit from damaging an adjoining unit, and the large number of units, up to about 25, precludes any stoppage of production unless a number are hit, as there are spare units in the plant. The columns are perhaps the heaviest steal construction known to industry and are built somewhat like a large caliber naval gun, about 4" thick armor plate, stand vertically, three to four feet in diameter and about forty to sixty feet high. A direct hit, highly improbable, would destroy it and make a considerable explosion with incidental damage.

Information given to the Staff (Major Kuter) on Vulnerability of Oil Plants.

I. Listed the equipment of these plants roughly in order of their vulnerability, as follows:

Bergius Hydrogenation

1. Compressors.
2. Converters.
3. Intercharger.
4. Boiler plant.
5. Hydrogen storage.
6. Raw material storage.
7. Aviation gasoline storage.

Fischer-Tropsch

1. Hydrogen converters.
2. Hydrogen generators.
3. Boiler house (huge).
4. Absorbers.
5. Gas cookers.
6. Contact chamber.

Refineries

1. Bubble towers (fractionation towers)
2. Reaction chamber.
3. Condensers.
4. Evaporators.
5. Power plant.
6. Compressors.
7. Cooling towers.
8. Agitators.

Modern refineries are, in addition, often equipped with special processes such as cracking, polymerization, alkalization, acid treatment, Iso-octane and hydrogenation plants, most of which are highly vulnerable and most important, especially for the production of high octane gasoline and the highest grade of lubricants.

Bergius Plants

An average size Bergius plant would include a compressor house about 60 feet wide by 300 feet long by 40 feet high, although the trend has been to reduce the height and put this unit underground, due to the extreme delicacy of these huge compressors, about 16 in number, and built for over 3,000 pounds per square inch working pressure. A near miss would probably put a number of these units out of action for weeks, although they are not interconnected.

Some 30 hydrogenation columns about 3 feet inside diameter by 60 feet high (or more) would be included, destructible by direct hits only, and not interdependent. The total area exposed by these is slight.

Interchargers are relatively small and well protected inside units.

The boiler plant is a huge room with high pressure steam boilers. There are about 16 of these, each approximately 12 feet in diameter by 40 feet long within a housing unit about 80 feet wide by 300 feet long, built of masonry, with massive brick settings for each boiler. The destruction of one of these boilers by a direct hit would probably involve the adjoining boilers but would not cripple the plant. Two or more extra boilers ("spares") to permit cleaning or re-tubing might be expected.

Hydrogen storage presents a larger target, consisting of a number of tanks about 30 feet in diameter, but only slight damage would result except from possible secondary explosion and fire. Incendiaries would probably effect this.

Raw material (tars) in a number of similar above-ground storage tanks would be easily demolished, but replacement could be made in a few weeks at most, possible without a holdup in production, which would continue from tank-car storage.

Aviation gasoline storage is now probably in smaller horizontal tanks which are readily placed underground or covered.

Refineries

Natural petroleum refineries vary widely in the character of their equipment. There are, however, certain units common to all. The fractionation towers are vertical steel tanks about 8 feet in diameter by forty to sixty feet in height, having a steel shell of about three-eighths of an inch in thickness and containing a mass of internal pipe coil for steam heating. The number of these towers vary widely, an average refinery having about six. They are highly vulnerable to attack and if destroyed would completely stop refinery processes but might be replaced within three to four months.

The reaction chambers are smaller but present a target area about equivalent to that of the fractionation towers. Similar damage could be done by air attack.

The condensers and evaporators are more scattered and smaller and would require about three months to rebuild, but are not as essential to the refining process for all purposes.

Most refineries include their own power plant which is generally operated on waste refinery gases or waste coke and tars. This power plant, of course, is a key central point, but consists usually of a large number of boiler units which are not interdependent, and would not require more than about three months individually to replace. The same applies to the compressors.

The cooling towers and agitators are relatively small units which, while important to the operation of the plant, might be readily replaced, often by factory-built units.